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Toggle Joint Drawing Presses.

In our issue of October 23, 1890, we illustrated a large drawing press which was driven by an engine attached, and in which there were some new features of construction, especially in the blank holder mechanism, the blank holder being made to "dwell" and exert its pressure upon the blank during the drawing operation, by means of a system of toggle joints, worked by connections attached primarily to a heavy sliding block at the side of the machine, one of the offices of this block being to counterbalance the weight of the blank holder and the plunger.

By means of this mechanism the blank holder is made to exert its pressure steadily, and without imposing any strain worth speaking of upon the working parts of the machine during the dwell—an action which not only saves much power, but also much wear and tear of the machine and expense for repairs. By reference to our detailed engravings, published in the issue referred to, the action of this mechanism will be readily understood.

The present illustrations show the largest belt driven, and the smallest machine (see page 2) built to employ this principle. In the larger one the motion is controlled by means of a friction clutch, which, while it acts in such a way as to effectually relieve the machine of injurious shock, at the same time acts promptly and enables the motion of the slide to be arrested at any point, and, in short, gives the operator full control of the machine.

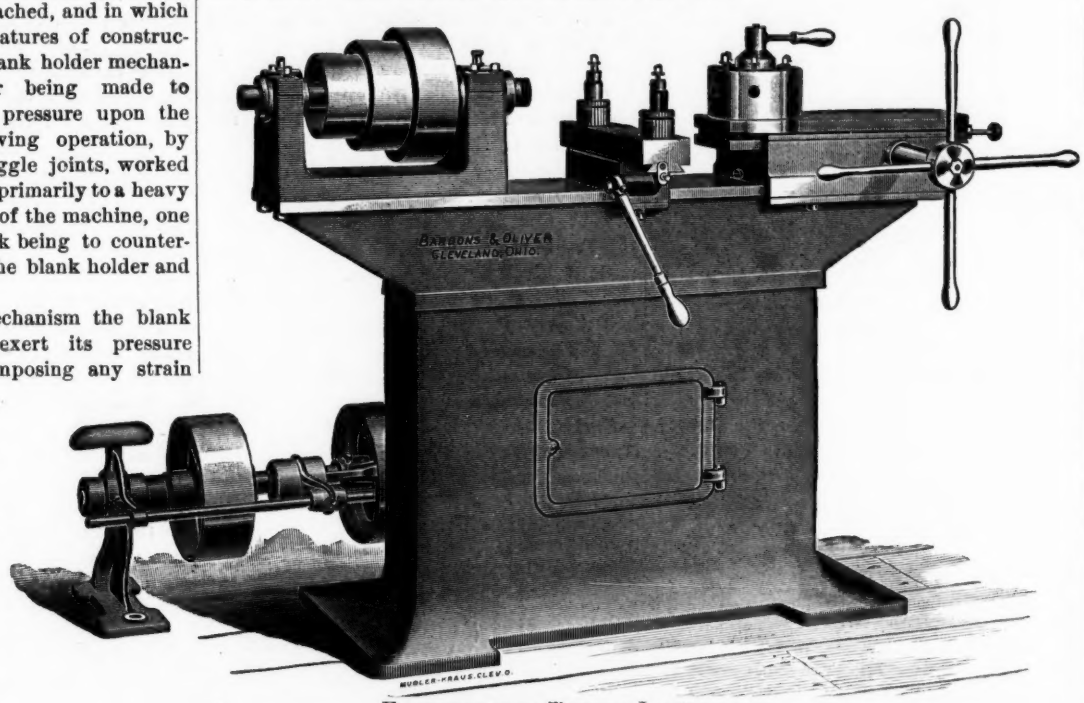
It will be noticed that the sides of the frame are straight, and the tensile stress imposed during the operation of drawing is taken by four 4¼″ steel bolts which pass up through the columns from the bed to the upper cross-piece.

This machine is adapted to drawing the largest and heaviest articles made of tinplate and nearly everything made of black iron or steel in the manufacture of enameled iron ware. It is also adapted to such work as is done in drawing the heads of kitchen and bath boiler heads, soda fountain cylinders, the smaller sizes of sinks, heavy brass and copper goods, and all work of similar character.

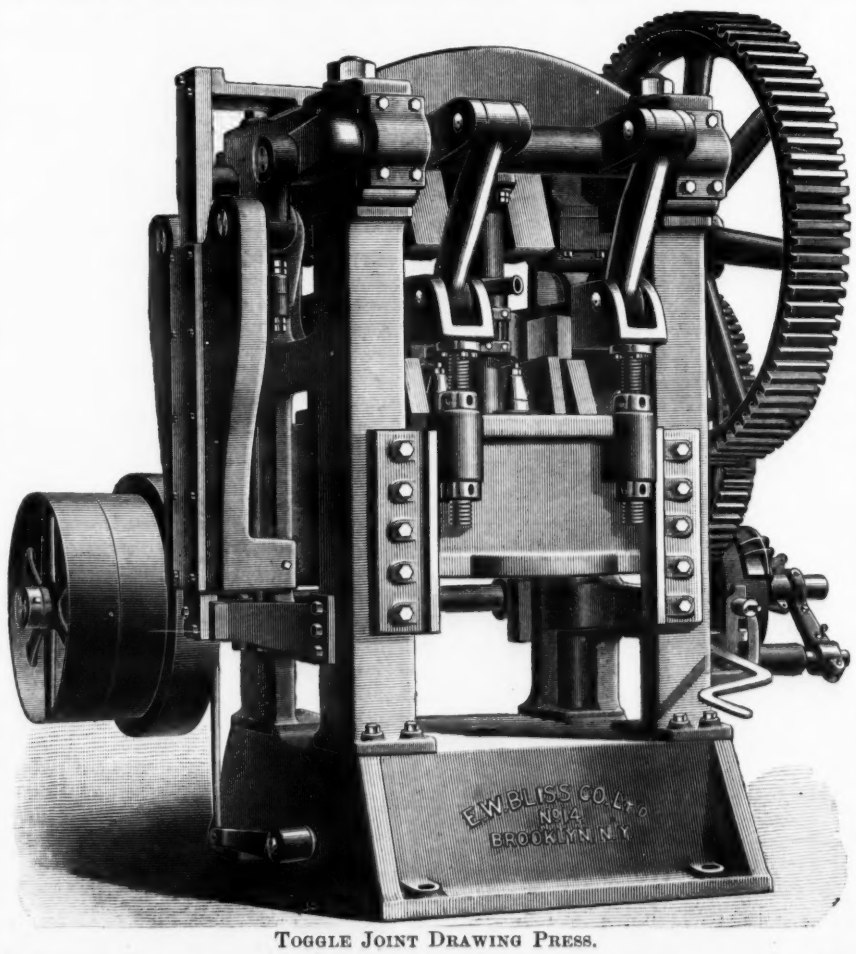
The width between the uprights is 46″; distance from bed to face of blank holder when stroke is down and adjustment up, 20″; distance from bed to face of plunger when stroke is down and adjustment up, 22″; stroke of blank holder, 15″; stroke of drawing punch, 22″; adjustment of blank holder 8″; and of the punch the same. The ratio of the gearing is 1 to 38½, and the machine is designed to work at a speed of 7 strokes per minute. The extreme height to the top of the gear is 163″, and the floor space occupied, 104x157″. The largest blank which can be drawn is 44″ diameter, and the largest punch which can be used is 31″ diameter.

The smaller press is adapted to all such work as is done in forming blacking boxes, baking powder can tops, lamp burners, parts of lanterns, gas fixtures, cartridge shells, etc. The toggle joints in this case are operated by cams which are placed on the crankshaft, the pressure which is placed upon the blank, and maintained during the drawing, imposing comparatively very slight stress upon the cams.

The blank holder in both these machines can be adjusted to secure an even pressure upon the blank all around, without the necessity for packing the die, screws being provided for that purpose. The crankshafts are of forged steel, with the cranks slotted out from the solid metal. The machines are built by the E. W. Bliss Company, Brooklyn, N. Y.



FOURTEEN-INCH TURRET LATHE.



TOGGLE JOINT DRAWING PRESS.

A correspondent writes us in relation to a recent article in the AMERICAN MACHINIST in relation to boiler explosions. He agrees with us in the main, viz., that competent men should be employed to manage boilers, but says that too many boilers are made, of which it is impossible to make a proper internal examination. There is no doubt a great deal of truth in this; but a competent man in charge of such a boiler will very soon find this out, and govern himself by the knowledge he has gained in so doing. In other words, he will refuse to stay with a boiler about which he knows nothing.

The point which we desired to make, in the article to which our correspondent refers, was that no one but a man skilled in the art of managing boilers was competent to decide as to their quality of safety. One of these qualities is the possibility of a thorough examination.

Fourteen-inch Turret Lathe.

We give on this page a general view, and on page 2 some details of construction of a new turret machine built by the new firm of Bardons & Oliver, of Cleveland, O., who have introduced some features worthy of attention.

The hollow column has been adopted as the support of the bed, for the purpose of giving the utmost strength and rigidity, and within the column there are shelves for the reception of tools and fixtures which can thus be locked up, good locks being fitted to the door for this purpose. By reference to the section of the head-stock, Fig. 1, it will be seen that more than usual strength has been secured here by making the uprights double or columnar, and greatly increasing their depth, besides which heavy sections of metal are employed.

It will be noticed also that the box is supported in the head practically its entire length, each end of the seat counterbored for the reception of the flange on the box. This not only supports the box very solidly, but reduces to the smallest possible amount the overhang of the work beyond the box.

The thrust of the spindle is taken on the front of the main box, and lost motion is taken up by adjusting the collar at the rear of the same box, all expansion or contraction of the spindle affecting the position of the rear end only where provision is made for it, and it can do no harm. The main bearing, as shown by the drawing, is 2½″x3¾″, and the cap is held in place by four bolts. The boxes are in halves and can be renewed, and the original alignment of spindle precisely restored by simply doing a good job of lathe work in making new ones.

Fig. 2 gives two sections of the tool, or cutting-off slide, with the manner of connecting to the lever and the arrangement of the stops, which are placed one in front and the other at the rear with jam nuts outside, so that the stops are easily adjusted and are free from spring or any inclination to yield when pressure is brought upon them. The tool-posts are provided with threaded collars, by which the height of tools is easily regulated.

Fig. 3 is a view of the turret slide and block, with a vertical section of the turret showing the method of securing it to the slide. The turret revolves automatically, and is supported upon a bearing which is of hardened and ground steel. There are six holes, 1¼″ diameter. The length that can be milled by the turret tools is 6½″. At each side of the turret slide there is a taper gib which extends the entire length of the slide, and can be adjusted by the screw at the rear. By this adjustment all side wear of the slide can be readily taken up and the

alignment preserved. The turnstile is fitted to the pinion shaft upon a square section, which precludes the possibility of its becoming loose, even with the most severe usage.

A speed of the countershaft of 350 revolutions gives for the spindle, speeds of 565, 350 and 316 revolutions. The machine weighs, ready for shipment, about 1,300 pounds.

Jacket Cores for Molding Steam Cylinders.

BY S. BOLLAND.

The subject of jacket cores is a very important one, and demands our attention for a time.

It is true that in many places they have so arranged matters as to make a very simple job out of what was once a very critical one.

I think the most critical jackets to deal with in dry sand work are those which allow of no other communication with the outside than can be obtained by about four round holes of the same diameter as the thickness of the jacket core, which, in this instance, we will suppose to be 2½ inches. These outlets, four in number, are equally divided at one end. Nearly all small cylinders of this class are made in loam, it being, by many, considered to be the only safe way to make them.

I claim, however, that such a job can be made absolutely safe in dry sand, if the plan of making herein suggested be adopted.

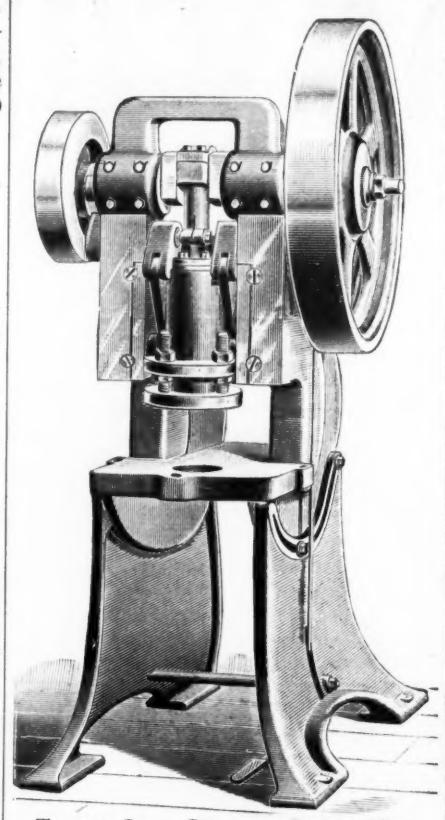
Fig. 19 (page 3) is the plan, and Fig. 20 is a sectional elevation of the jacket core; *A*, *B*, *C* and *D* in plan represent the position of the four holes spoken of, through which all the gas generated in the core must pass, as they are also the only ones through which to withdraw the same after it is cast.

It will be seen that the core iron is simply a cage composed of three rings, as shown by shaded portion in plan, into which are cast the rods, cast or wrought, represented by black circles in plan; at *A*, *B*, *C* and *D* pipes are substituted for the solid rods, through which all the gas will pass, preparation for that object being made by filing holes at intervals along the pipes, as shown at *A*, *B*, *C* and *D*, Fig. 20. The white circles on the plan represent holes cast alternately with the irons and pipes, through which vent rods are passed when the core is made.

To cast this cage, make middle ring, and thrust irons and pipes down into the soft bed the requisite depth, then cast and lift the whole into the second ring plumb and to the correct depth; another similar operation for the opposite end, and the cage is made.

The four pipes must be long enough to stand through the core, as shown at *E*, Fig. 20, so that, when the jacket core has been made, the cores may be slipped on and made secure.

To make such a core, strike up a dummy with bricks and mud, as loosely built as possible, and after thoroughly drying said dummy, and preparing for separating easily, place over and around it the cage, set in the



TOGGLE JOINT DRAWING PRESS.—SEE PAGE 1.

vent rods all round, and strike up the whole in loam of a good open nature.

When this core has been dried the dummy may be dug out, and the vents connected after this manner. File out a gutter opposite each of the holes indicated at *A*, *B*, *C* and *D* in the pipes, and at the same time cutting into the vertical vents *E*, as seen at *F*, *G*, *H* and *I*; into this gutter a greased rope must be set, and the gutter made good over it, the rope being drawn along as piece after piece of the break is mended.

When this has been done, and all holes, except the pipes, have been securely stopped, the core may be considered a perfect one, as far as vents are concerned.

At *J* and *K* I have shown lugs cast on the ring, and afterwards tapped for lifting purposes, and at *L* will be seen how to make an absolutely safe connection when it is desired to bring the gas away through passages in the side, which is simply to cast a lug on the ring in correct position, and have a main vent directly at the back of the lug. This lug is to be tapped so as to receive a pipe which has been threaded at both ends, the outer thread being used for securing the nozzle core to the jacket. When this is properly done, a direct communication is preserved with the core vent, and no possibility of any iron finding its way into it.

Fig. 21 is a plan of the mold showing body core *A* and a sectional view of the jacket core in position.

Fig. 22 is a side elevation of the mold showing the jacket core *A* in position, supported by studs, as seen at *A B*, Fig. 23.

To enable the reader to better understand the upper arrangement for setting the jacket, I have shown the form of the top end of the lower half of the flask used for this job at Fig. 24. It will be seen at *B*, Fig. 22, that, instead of parting the mold at this end in the usual way, I have carried the pattern, block fashion, as far past the end, and full size of pattern, as will give sufficient bearing for the body core, making the parting over the top, and leaving a good body of sand between the end of pattern and flask, as seen at *C*, Fig. 22.

Fig. 25 will explain the way in which the cores are arranged that fill the block, and at the same time surround the four vent cores shown at Fig. 22—which pass through the holes marked 1, 2, 3, 4, 5, 6, 7, 8, Fig. 24, and are there made fast to cross-bars, the remaining four holes being those prepared for the vent pipes.

After section *E*, Fig. 25, has been placed in position, as seen at *E*, Fig. 22, the jacket core is set, and sections *F* and *F* put in, as seen at *F*, Fig. 22. This disposes of the two lower holes, and brings us up to the middle of the joint, as well as forms the seating for the body core, which is now inserted by entering it at the opposite end, that end having been made an open one for the purpose; sections *G* and *G* are now added, as seen at *G*, Fig. 22, and the whole capped with section *H*, shown again at *H*, Fig. 22.

A careful inspection at *E*, Fig. 20, will show how easy it will be, in this case, to make the outlet for the vent secure. All that is needed is to have the ends of the pipes threaded, on which can be screwed connections which will reach through the end at holes *J*, *J*, *J* and *J*, midway between the figured holes, as seen at Fig. 24, also at *J* and *J*, Fig. 22. These holes must be made large enough to permit of sand being rammed round the pipe, thus making the whole job a very safe one.

The system of studding adopted in this example will show how the molder may control every chaplet and stud used in the job, and by so doing leave nothing to chance.

It is best to have top studs secured after the plan shown at *K* and *K*, Fig. 22, and again at Fig. 23, clamps being either cast in or bolted to the cross-bars for the purpose; the end studs, shown in plan, at Fig. 26, can be secured thus: Let bottom studs *L* and *L*, Fig. 22, be set back until the jacket core is placed; they can then be brought forward and wedged behind; those at *M* and *M* being at the joint, can be readily adjusted, as also can the one at *N*; the one shown at *O* can be set back so as to clear the jacket core when the cope is lowered over, when it can be pushed forward and wedged, as shown, provision being made for this by leaving a hand hole at the point *P*.

Another class of jackets are such as connect the outer with the inner shell by a series of ribs lengthwise with the cylinder, allowing for as many separate cores as there are ribs in the casting.

Usually a small hole is allowed on the bottom of each core, with a somewhat larger one at the top, and this one can be utilized for carrying off the gas.

Of course these cores must all have their own vent; but as this can be done by passing a wire or wires from one end to the other, these cores are not very difficult to manage.

It is not a very difficult job to make such cylinders in dry sand. Fig. 30 shows sectional elevation of mold, looking at the end; Figs. 27, 28 and 29 show plans of the bottom half of mold and cores in section; Figs. 27 and 28 show the arrangement of all the cores, when the bore is straight through. *A* in all the figures represents the body core

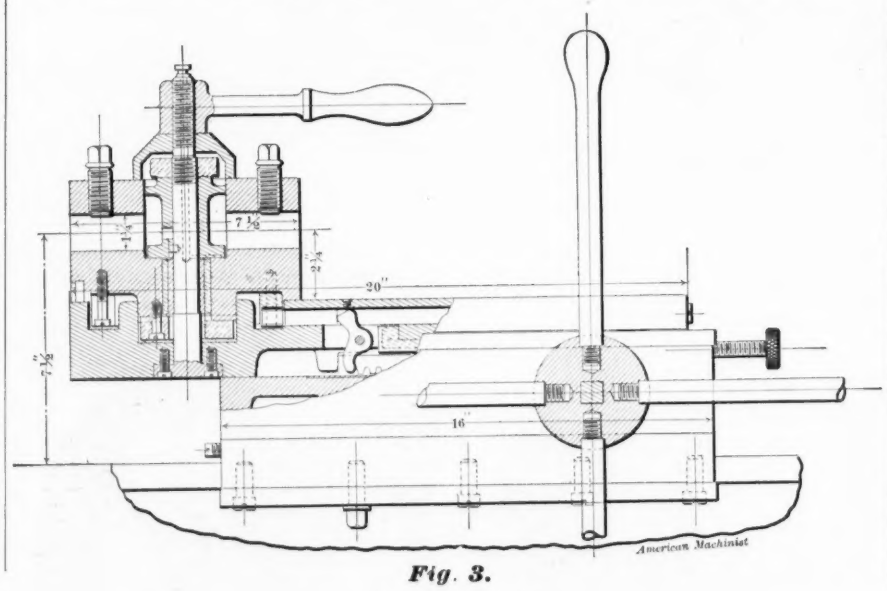


Fig. 3.

Plan of Front Cap.

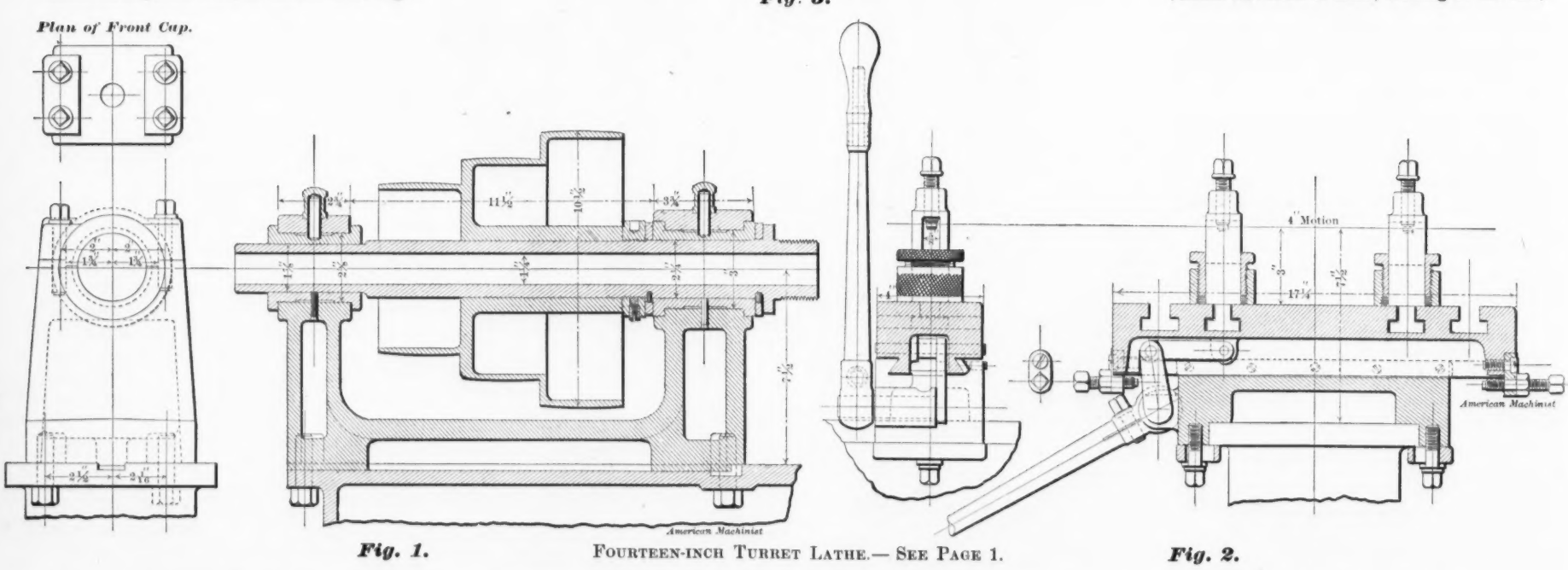


Fig. 1. FOURTEEN-INCH TURRET LATHE.— SEE PAGE 1. ***Fig. 2.***

as resting on the jacket cores marked 1, 2, 3, 4, 5 and 6 in plan, Fig. 30, equally divided on each side of port cores, indicated by broken lines at *B*.

When the body core has been set, all that remains to be done is to set the cores 7, 8, 9, 10 and 11, Fig. 30, and proceed to close over the upper half of mold.

It is important that all these cores should be the very best that can be produced, every precaution being taken to use none but what are perfectly sound; the best core iron for such a core is the one shown in section at Fig. 31, *A* being section of core proper, exposing vents, and *B* representing the addition at the ends with gate or runner *C*. Fig. 32 shows the form of the iron as it lays in the core box, and it is plain that with such an iron there can be no difficulty in making a reliable core.

Fig. 29 shows section of bottom half of mold with the cores all set, when there is to be an internal flange cast on the cylinder, as shown in figure.

The reduction of diameter of core, as shown at *C*, Figs. 29 and 30, necessitates the use of two half cores to fill the space, as shown at *D*, *D*, with body core resting in bottom half.

By again referring to Fig. 30 it will be seen that, when body core *C* has been set upon block core *D*, all that remains to be done is to secure the other half of block core *E* in position, and proceed as before directed.

In making flasks for this job, prepare for taking the gas out at the upper end of jacket cores, by casting holes in the box end, through which to pass the vent pipes, as shown at *B* and *B*, Fig. 27; also in arranging the cope bars, let the end ones in each case be placed so that the end spaces may be left unrammed, exposing about one-third of the print end of the jacket cores, as represented by broken lines in Figs. 27, 28 and 29. This will enable you to make the whole arrangement of jacket cores absolutely safe, by ramming in sand at the ends after the cope is closed.

Whitney's gin is the fundamental part of cotton-working machinery, and it has been the main instrument in developing that portion of the country where alone cotton will grow. Surely the man who gave to the world an invention which has added hundreds of millions to its wealth and given millions of people a chance to earn their living, is as well deserving of a monument as the man who has fought a successful battle in his country's service.—*Philadelphia Inquirer.*

A gentleman in this city has a relic of continental money in the shape of a piece of scrip, originally valued at twenty shillings, which has been in his family more than a hundred years, and is especially prized for that reason. It formerly belonged to the Valentine family, who lived in Milk street, now Beaver, and came originally into the hands of one of the members who fought in the War of Independence. The scrip is about four by two and a half inches in size, and of the color of parchment. It is numbered 3,928, and is embellished with a lion and unicorn surmounting four crowns. It is inscribed: "Twenty Shillings, according to the Resolves of the Assembly of Pennsylvania, made on the Thirteenth Day of June in the Fifteenth Year of the Reign of his Majesty Geo. III. Dated at Philadelphia the Twentieth Day of July, 1775." Appended are the signatures of John Benezet, Samuel C. Morris, and Samuel Cadwalader. On the reverse side are the words, "Twenty Shillings. Printed by Hall and Sellers, 1775." Ex Gov. Cornell is said to have another specimen of this scrip money.—*Evening Sun.*

The watchmakers of Switzerland, at a recent convention in Berne, decided to make an exhibit at Chicago of their finest and costliest watches, but not to attempt any competition with American manufacturers in cheaper grades. They have applied to the Swiss Council for financial and other aid to enable them to make a creditable exhibit.

Designing New Machinery.

BY HENRY B. MORRIS.

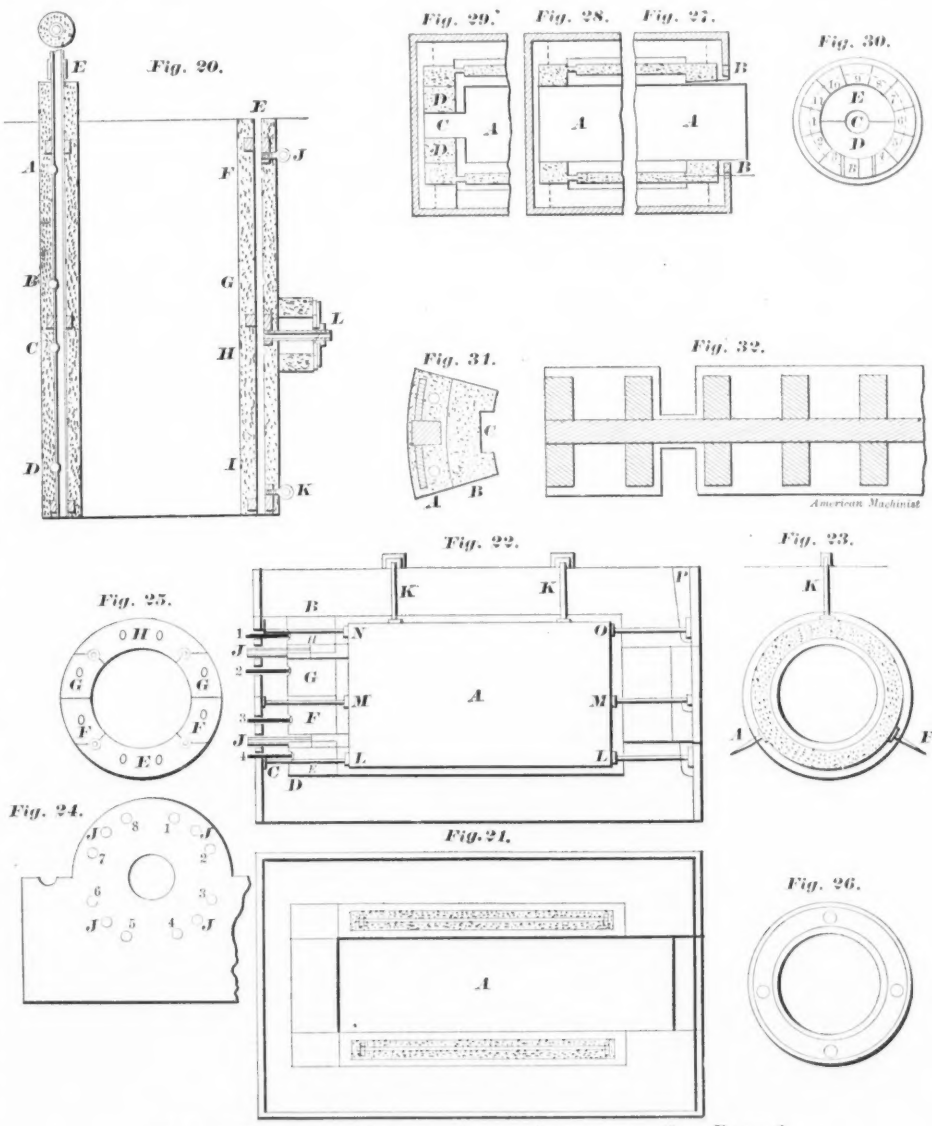
I.

One of the most striking features of the enormous development within the last few years of the science of mechanics, is its constant tendency to differentiate and subdivide itself into separate departments entirely distinct from each other. This is, of course, a natural consequence of the vast growth of the art, the gigantic bulk of the business involved, and, more than all, of its application to almost every subject upon earth which engages human industry and skill. Some matters, indeed, there are, which are common to all branches of the subject—the laws of physics, the use of machine tools, and knowledge of materials. But these things are rudimentary, and, in our day, the young mechanical engineer who would achieve success must, as a rule, go farther, and become a specialist in some direction or other.

There is, however, a large and ever widening field for the exercise of high mechanical skill, which belongs to no well defined class or branch of the science—I mean the creation and development of the thousands of forms of special machinery which are now so universally used in the arts. The demand for professional skill in this field is great and constant; but success therein is difficult, and only to be attained as the result of the most thorough technical knowledge, wide observation, and generous experience, joined to the soundest, most analytical judgment. The engineer who is satisfied that he possesses the last named quality, can, perhaps, do nothing better than to arm himself with the others, and devote his attention to the subject of new and special machinery. This is eminently a branch of the business where there is "plenty of room at the front."

Every progressive manufacturer is, now-a-days, so familiar with the cheapening effect of machine processes, that when a new article is to be produced his first thought is to "get up a machine" to do the work. For this purpose the mechanical engineer is called in, and a new, and often unheard-of problem is put before him, which he is expected to solve, almost as a matter of course. Everything else is made by machinery; and why shouldn't this be?

Fifty years ago, the engineer who was called upon to perform such operations as this had a chance to distinguish himself as an inventor. The science of mechanics was in a very different state then from now. Multitudes of ingenious devices which are to day familiar to every one were then evolved as original dis-



JACKET CORES FOR MOLDING STEAM CYLINDERS.—SEE PAGE 2.

Interviewing an Engineer.

I thought from the general appearance of the man, and from the way he looked up every time the whistle sounded, that he was a railroad engineer, and when I made bold to ask the question I found I was right. After we had conversed for a few minutes on general topics, I asked:

"I suppose you have had your share of narrow escapes?"

"Yes, but not on the rails," he replied. "I was once shot at in a saloon, and I once fell off the roof of a church. I never had an accident on the road."

"Were you never flagged for a bridge carried away by a freshet just in time to prevent an awful calamity?"

"Never; bridges always all right."

"Ever almost crash into another train?"

"Never."

"But you've run over people?"

"Never did, sir. People always get out of my way."

"You have at least been very anxious when rushing through the darkness with hundreds of lives in your keeping?"

"Yes—anxious to get home, I suppose, but I don't remember any particular instance."

I wasn't at all satisfied thus far, and after pausing to take breath, I asked:

"Were you ever startled by thinking you saw an open switch when too late to stop the train?"

"No, sir. The switches are always O. K.," he replied.

"I have been told that some engines seem to be possessed of human intelligence?"

"Yes, I suppose so, but we don't use that kind on our road."

"Many brave men have died with their hand on the throttle."

"I presume so, but I don't want to die that way. I want to die at home in my bed."

I was determined to get something out of him for a sketch, and so I persisted:

"Did you never have your fireman go crazy while on a run?"

"Never."

"But you must have been prepared at some time or other to sacrifice your life to save your train?"

"No, sir; I never have. You don't seem to understand the business. I simply run to Chicago and back, and sometimes make as high as $110 per month. That's about all there is to it, and if you are after perilous adventures, you should interview street car drivers. I understand that they take their lives in their hands every day in the year."—*Detroit Free Press.*

"Yes," said the reminiscent traveler at the Charleston Hotel last evening, "I was in Charleston at the close of the war, and shall not forget a scene which took place on the Citadel Green the day the battle of Secessionville was fought. The rattle of firearms could be distinctly heard in the city, a crash now and then telling when the fire was by volley. The excitement was intense, as you may suppose. A well-known fire company was drawn up on a parade ground. The reserve in the whole city was ordered out, among them the fire brigade. The captains of the several companies were haranguing their men. Company —— presented a fine appearance. They were mostly mechanics employed in the different machine shops, and their intelligent faces were full of animation. Their captain, however, was something of a humorist, and addressed them with a smack of the brogue from over the sea. 'The eyes of the country is on you,' he exclaimed, 'and the road to honor lies open before you,' said he, though pointing with his sword to James Island, where the noise of the fight went on. 'Follow me, boys, and on the word of an officer and a soldier, not a man of you will be hurt.' A shout of laughter cut off the balance of this hero's war cry to victory or death."—*Charleston News.*

Rubber Pattern Work.

BY JOHN T. USHER.

GROUPING PATTERNS.

Any pattern that is made in one piece can be grouped together with a number of other patterns, whether the patterns are of the same kind or not. The patterns to be so grouped can be molded and cast all together in the same flask, and then finished all over (including the gates), or they can be cast separate, and, after being finished, can be attached to the gate channels by screws or by soldering; the latter method is the one usually adopted.

Fig. 11 shows side and sectional end views of a nosing pattern.

Fig. 12 shows a top view of a group of these patterns, which are intended to illustrate how these and all similar patterns are usually arranged in grouping.

In grouping patterns, three things must ever be kept in mind:

First. To so arrange the patterns as to get the greatest possible number in a given space, or in a certain sized flask.

Secondly. To so arrange the patterns that the distribution of the sand in the mold *all around the patterns* shall be such as to insure the greatest possible resistance to the pressures of the hot metal and gases in pouring the molds.

Thirdly. To avoid in all cases having the patterns too close together. I would, therefore, suggest that the foreman of the foundry be consulted in each case regarding the general arrangement and distribution of the patterns in grouping. In most cases where large quantities of castings are to be made from the patterns grouped together, it will be found more satisfactory to group the patterns on a "match plate" or "card," as the number of patterns grouped by the ordinary method seldom exceeds one-fourth of the number that could be grouped on a "match plate," or "card."

Grouped patterns are always used in connection with a follower board (or where the follower is made of other materials, as "plaster of paris," sand and glue, etc., they are sometimes called "hard sides"). There is one method I would suggest by which I think the full number of patterns can be grouped together, and a card used with a decided advantage over the ordinary method of grouping to a gate.

The proposed plan is as follows: Fig. 13 shows side and sectional side views of four castings, which, together with a rivet (not shown), form a catch or fastener for windows, and which, as they are familiar objects everywhere, and on account of their varied and complex forms, and the fact that there must always be the same amount of castings made from each, will serve to illustrate the foregoing and the following text much better than some less familiar object. The patterns are to be arranged and grouped together precisely the same as they would be for carding, except that, instead of being split (as would be the case with the pattern *d d'*, Figs. 13 and 14), they must be arranged to lay upon a level or plane surface.

The gate channel patterns are soldered to the patterns to be grouped, as shown at Fig. 14 (which are arranged for a flask 16x21"). The card is then arranged as though it were a follower board (which it really is), having pieces permanently fastented on the card to fill the inside or hollow portions, and also to stop off all undercuts of the patterns; then at two or more points in the gate channel patterns locate and fix a dowel pin, and drill the clearance holes for the pins to fit into in the card. Where it is desired the sprue and riser channels should be (in this case they are arranged where the risers would be), arrange a clamping device as follows: A hub-shaped piece *B B'*, Figs. 14 and 15, having its upper surface divided into two inclined planes, is formed at the points mentioned above. Then, after placing the group of patterns in position on the card, clamp them firmly to the card (for the time being); a $\frac{3}{8}$" or $\frac{1}{2}$" hole is to be drilled through the center of the two hub pieces, and continued through the card also. These holes are then plugged that two or more $\frac{1}{2}$" holes may be drilled on each side of the center holes (at the lowest points of the inclined planes); the plugs are then driven out and a slot formed on each side of the center holes, through which the clamp bolts, *A*, Fig. 15, are to be passed. The clamp bolts, *A*, Fig. 15, are then passed through the holes and given a quarter turn, which, owing to the inclined surfaces on the hub pieces, locks the pattern to the card; a thin copper cap is then to be fitted over the hub and bolt, to avoid the resistance which would naturally occur in turning the clamp bolt when embedded in the impacted sand; said cap can be fitted tightly on the hub or soldered thereon, but must not interfere with the movements of the clamp bolts. The temporary clamp can then be removed, and the card is, if otherwise finished, ready to mold with.

To make a mold, proceed as follows: Place the card, with the pattern locked in place, between the two halves of the flask, and proceed to make a mold on that side of the flask where the patterns are; place on the bottom board, turn the flask over, take off the cope, give the clamp bolts a slight turn back and withdraw them; lift off the card, leaving the patterns in the mold; replace the cope, placing the sprue or riser sticks in the clamp hub holes, as the case may be (said sticks to have a tit on the end to fit into the clamp bolt holes, and thus prevent the sand from getting into the bolt holes), and proceed to make up the other half of the mold as usual; when completed take off the "cope," replace the card and bolts, giving the latter a slight turn to lock the patterns to the card, and the patterns can be lifted out of the mold altogether. The mold is then finished as usual.

Where it is desired to cast and finish the grouped patterns all together, and but one preliminary pattern is available, the patterns can be molded and cast in the sectional flask, Fig. 3, issue of October 15th, as explained in that issue, omitting, of course, the distance pieces therein mentioned.

This concludes the subject of metal pattern work. The following papers will be devoted exclusively to rubber pattern work for the purposes before mentioned.

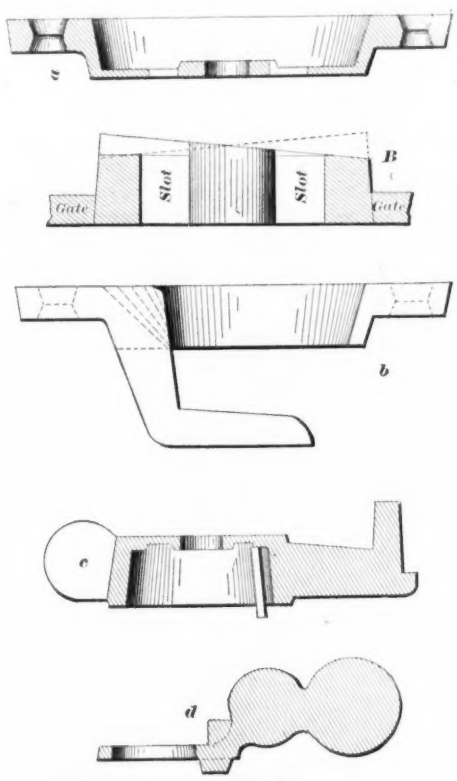


Fig. 13.

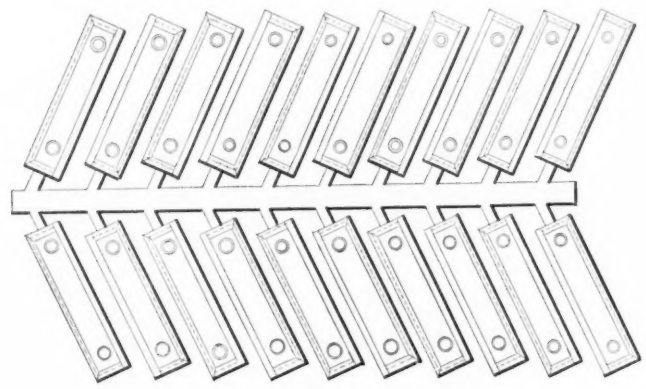


Fig. 12.

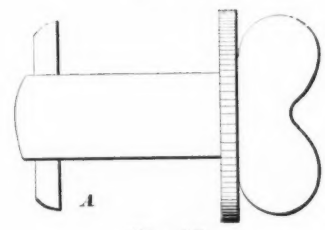


Fig. 15.

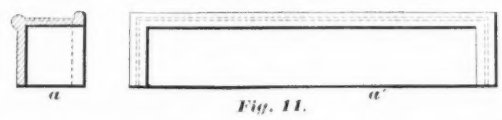


Fig. 11.

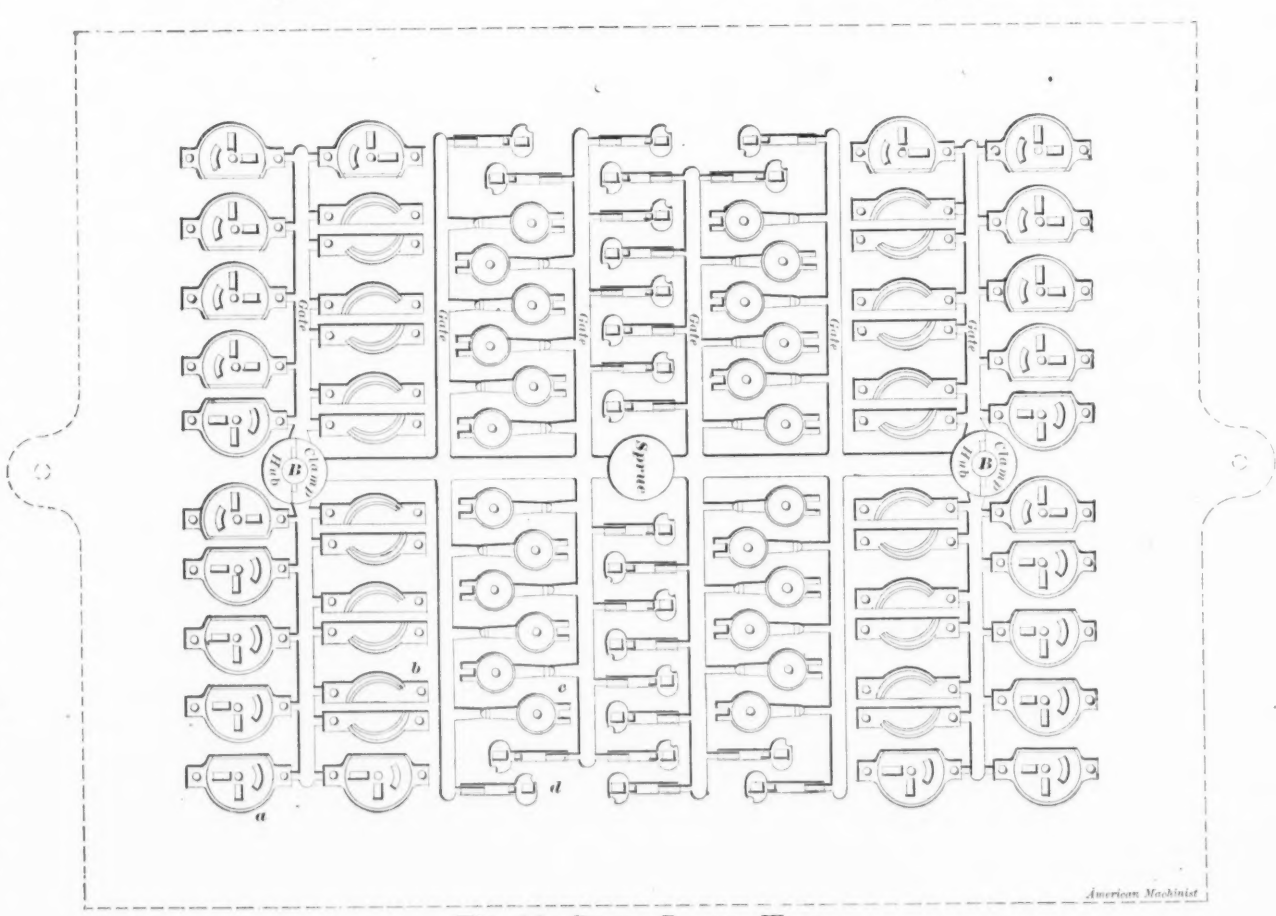


Fig. 14.—RUBBER PATTERN WORK.

English and American Locomotives.

BY W. H. BOOTH.

In all that appears on this subject, there is one thing which particularly strikes those of us whose experience has been largely amongst stationary engines, namely, the entire absence of reliable data.

Elaborate papers are brought out by locomotive men, and grave comparisons are drawn, in which the factors of calculation are such items as coal per ton per mile: coal per vehicle per mile, as though a vehicle were a standard quantity. Even when the ton per mile is given—a better guide certainly than a train mile or a vehicle mile—the absence of any speed record entirely deprives the figures of value. Even Mr. Forney, who knows better, rounds up his recent arguments on the coal per ton per mile basis, and I believe omits speed altogether, though he must know that a locomotive which will burn say half a pound per ton mile, at a jog-along speed of 5 to 8 miles per hour, would burn very much more if pushed along at 40 or 45 miles per hour—a common speed, by the way, for English freight trains.

Very little information is available of the power indicated by locomotives.

Some results were published a few years ago of the running of an express engine on the London & Brighton line. It appears that the horse-power, when running, varied from 668 to 431, one diagram only on the run showing lower, namely, 374.

The coal consumed—including lighting

up—was 27½ pounds per mile for a total train load of 751,968 pounds.

It appears that the mean speed was 43.38 miles per hour, and one pound of coal therefore conveyed one ton of train over 15.12 miles at that speed, which is .066 pound per ton per mile.

If you take the maximum horse-power of 668, and the coal used per mile, 27½ pounds, at the speed of the maximum diagram, 47 miles, we have, as the coal used per minute, $\frac{47}{60}$ of 27½ pounds = 21½ pounds, or, more nearly 1,292 per hour. This is 1.93 pounds per horse-power per hour. This is, of course, less than the actual amount.

Turn now to the *Railroad Gazette* of Dec. 11th last, where is given a test of a Baldwin 10-wheeler. In this case the maximum power is 1,327, the speed 20 miles per hour, and the coal 226 pounds per mile, with a train of 615,900 pounds. These figures show .734 pound of coal per ton per mile. Worked out from the maximum horse power of 1,327, and the speed of 20 miles, the 226 pounds of coal per mile comes down to 75 2 pounds per minute, or 4,512 per hour. Dividing by 1,327, the maximum horse-power gives 3.4 pounds of coal per horse-power. Thus by one method the coal per ton used by the American engine is over 11 times the English consumption, whereas by the horse-power method it is slightly less than double the English consumption. Now, though this may seem to be damaging to Mr. Forney's arguments, it really shows how unreliable are the data to which we are accustomed. The American horse-power never fell below 800, and I think I have picked out a favorable run from the six given in the records.

One thing is remarkable. The American engine with a total load—including itself—of 308 tons, developed from 800 to 1,000 horse-power (and once 1,327 horse power) for a speed of about 20.62 miles per hour, whereas the English engine only indicated from 427 to 668 horse-power for a total self-included load of 376 tons at a mean speed of 43.38 miles per hour. The American test was made on the Piedmont grade, averaging 2.2 per cent. The English run was made on an undulating line, the steepest gradient being only 1 per cent.

The gradient difference alone is not enough to account for the very excessive power required by the American train.

Part of the excess is due to the fact that the English train was passenger, the American, freight; to the probably excessive axle load of the American train as compared with English practice; to small diameter of American car wheels; and finally to inferior quality of tracks.

If we turn to the evaporation per pound of coal we are met with 5.3 pounds per pound of coal in the American, and 12.95 in the English test. There is an uncertainty about this latter figure, because of a special exhaust steam condenser which was used and was a great aid to economy, but 12.95 was probably over-estimated. So far as a comparison of two solitary tests can show us anything, it teaches that there is economy in fuel where trains run easily, and that the American practice of heavily loading axles, and the use of little wheels on inferior track, has to be paid for in fuel. After all our trouble, we are still face to face with the question of fuel efficiency. I am certain that the large horse-power demanded from American engines makes such a demand on the boiler, that harsh tearing blasts very seriously reduce the furnace efficiency. Whether there is a real inferiority in American coal admits of argument.

A firm of English boiler makers at one time published some tests made of their patent boiler in America. I am pretty sure they never got such good results with English coal; but, of course, there is a large element of perhaps unconscious exaggeration in their claim. An American boiler is advertised here which I know will not give the evaporation it has shown in America. There are no reliable comparative tests known to me of the merits of coals here and in America from which we can gain real information.

That the American engine burned 173 pounds of coal per square foot of grate is indicative of the heavy blast used, and also, it would appear likely, of the very fair quality of the coal.

Such a rate of consumption, however, does not appear to me to be compatible with proper combustion. A fire thus drawn will probably lift on the grate, and much air will be drawn through in excess of requirements, and no doubt a heavy charge of cinders will be found in the smoke box.

To me the tests say that American railroad management, and what we should call the permanent way department, don't care a cent for the locomotive department; that cheap transport of freight by American railroads is attributable to the large quantity of stuff to be carried in bulk, and the small proportion of dead weight.

Though the overloading of the axles is wasteful of power, and detracts from the nominal efficiency of the engine, yet the saving due to the reduction of the non-paying dead weight more than outweighs this, and the final cash result will be better.

We cannot, however, rate the mechanical efficiency of a locomotive from its paying load.

A locomotive knows only the drawbar pull, and doesn't care if this is made up of 18 cars running free or 12 cars, one of which has the brake on.

It would conduce immensely to the value of the locomotive discussion if we would all of us go no further back than a drawbar dynamometer, and use the indicator on the cylinders. We could then simply refer the power developed to those responsible for the design of cars and track.

Knowing the horse-power exactly, as we could do if we used a continuous indicator—self-recording—it would be easy to refer to the water consumed, and fuel. American railway managers would then see what it costs them, or what it saves them to so order things that locomotives are over-worked, and English managers would see how wasteful is their system of half-loaded cars.

As regards bituminous coals, an experience of many years convinces me that in no type of boiler can they be economically or completed burned without such arrangements of furnace as regards air admission and bridge wall of fire-brick, as is represented by the English practice of fire-brick arches, and deflector plates in locomotive fire boxes, and by equivalent devices in cylindrical, vertical and flued boilers. I am equally sure that no furnace can be satisfactory unless the depth of fuel on the grate is proportionate to the draught intensity.

American locomotives do not have deeper fire boxes than English locomotives. How then can it be fair to put them under such a heavy draught when they have not room for the depth of fire in the box?

The result is wasted fuel, and cannot be otherwise; and under the circumstances it is manifestly unfair to condemn an American locomotive as uneconomical. As a fact, it is over-worked at the drawbar, and frequently run too long without attention, until valves and pistons leak, and the fire box has to answer the demand for too much steam.

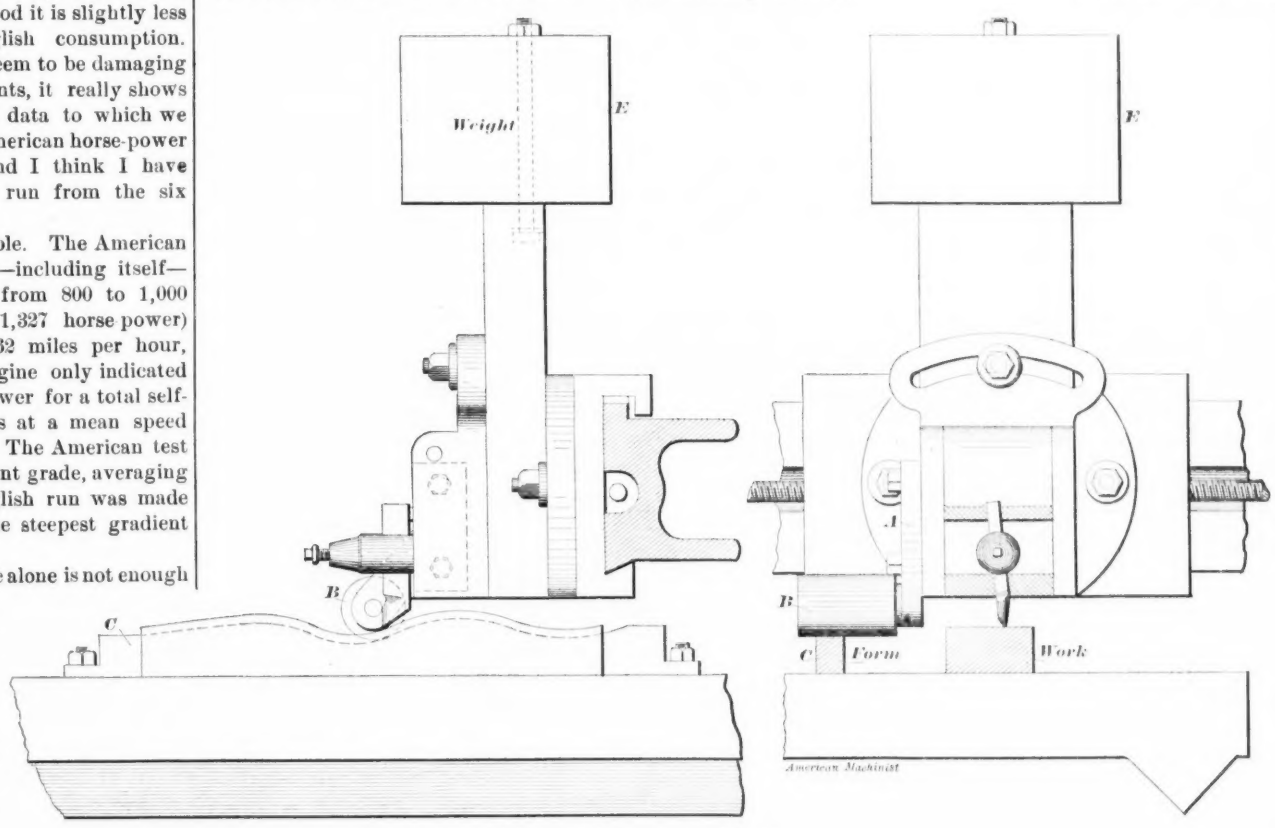
LETTERS FROM PRACTICAL MEN.

Planing Irregular Forms.

Editor American Machinist:

I send with this a plan I have used for planing irregular forms that may be new to many of the readers of the AMERICAN MACHINIST.

As will be seen by the drawing, a bracket *A* is bolted to the tool head, carrying the roll *B*, which runs in contact with the form *C*, which form has been laid out and worked to the designed shape.



PLANING IRREGULAR FORMS.

The down screw is removed, and a weight *E* is bolted to the down slide to keep the roll in contact with form.

In the shop where I used this rig it was designed to plane curve guided bars for "mulley" saw mills; but, as will be seen, a great many irregular forms can be planed in this way. It will be seen that, in order to plane over very abrupt curves, the end rake of tool would have to be so great that the edge would not stand well; but for easy curves it is a good idea. The only way they had in this shop to adjust the cut was to drive the tool down; but, of course, this could be improved if so desired. I have shown the roll located opposite the tool; but, of course, this is not necessary if the form is bolted to the platen to correspond.

As I said before, this was used to plane what were supposed to be true curves; but, of course, the accuracy of the curve will depend upon the form.

I suggested in this shop that for planing true curves with this rig they use a curved shoe in the place of the roll to fit the curve of form, and long enough so that the little irregularities of the form would not be produced on the work.

I made a form of cast-iron by laying it out with a tram and filing it to shape, and got it about as true as I could.

I planed two or three pieces to this form, which looked all right to me, but the foreman, in going up-stairs a little way from there, happened to get into a position where he got just the right light on my curved surface, when he called me to go up there. I could see from there that my supposed nice true surface was not so, but only a lot of little hills and valleys. I thought then of the shoe in the place of the roll, and suggested it to him, but I do not think they ever tried it.

For planing true curves there are better plans in use, but for the purpose I show this for (irregular forms) I do not know whether there is anything better in use or not.

A MECHANIC.

Foundation for Drop Hammer.

Editor American Machinist:

In your issue of January 21st inst. a correspondent inquires about a foundation for drop hammer. I have lately seen a 3,000-pound steam hammer fixed on a soil such as he mentions, and I will explain how it was accomplished.

The hammer proper was fixed as follows: Excavations were sunk to the depth of eleven feet, and about twelve feet by seventeen feet breadth and length; then two spaces, one each side and parallel to each other, leaving a space about four feet wide between them, was parted off; then concrete was put in, to a depth of two feet, well rammed all over afterward, substantial masonry was built up to within one foot of surface, then two pieces of yellow pine 12″x12″ spanned the opening and were well bolted down with bolts 1½″ diameter that extended to the foundation and passed through suitable binders bedded in the concrete. Two other timbers same size as the above were cut long enough to fit tight between the others, and bedded all their length on the piers. The hammer was firmly bolted to these four timbers.

The anvil rested on timbers having the same sectional area as those used for the hammer, and the same kind (viz., yellow pine), and were laid as follows: Two were cut off sixteen feet long, lying parallel and against the faces of the piers; then short ones enough to cover those their full length and allow clearance endways. The space was filled thus to the proper height of anvil, care being taken to give them all a proper bearing. The anvil was kept in place laterally by spiking scantlings around bottom flange, and encircled nearer the top by the bottom of hammer. There is very little vibration of the surrounding floor, especially since the first day or two.

The concrete used was made of cement and crushed stone in the proportion of one to three.

Builders in England use "ground lime" instead of cement, which is, I believe, ordinary blue lias lime, ground fine, instead of water-slacked; it is almost as quick-setting as Portland cement, but is not ground quite as fine.

I do not mean that English builders discard cement altogether; what I wish to say is that the lime is used for concrete and foundations generally. WM. NEWTON.

Machine Shop Characters.

Editor American Machinist:

There are many things to be learned in the machine shop by keeping one's eyes open, and observing the characteristics and idiosyncrasies of our shopmates.

There is, for instance, the much talked about and well known man who "knows it

all." You can tell him nothing that he does not already know. It doesn't matter what sort of a job you are doing, he will tell you how he generally does it, even though it is the first of its kind. He is always afraid that you will spoil the job, because you are not doing it as he thinks it ought to be done.

You will also find the man who thinks that "anything is good enough." You will recognize him by looking into his tool chest or drawer. It looks like a veritable junk shop. His hammer handle is without a wedge, or it is split; his chisels always have a fringe on the top, which would make one think that they had been hit with a sledge; his squares and fancy tools (if he has any) are scattered about among the files and scrap that invariably accumulate in the bottom of his drawer. The work that he turns out is on a parallel with his tools; if he is a lathesman, he will try to cut out a sharp corner with a round-nosed tool, and as a natural consequence manages to cut a groove into the mandrel.

Closely related to him is the man who never calipers his work until he has taken off too much stock, and then wonders why it is that "Jim" seldom or never spoils a job, while he is always in hard luck. If he is keying a wheel onto a shaft, he somehow manages to file off enough of the key to make it drive chock up to the head before he knows where he is.

I must not forget the chronic borrower. He has that nice, smooth, oily way of coming up to you with a "Say, Bill, lend us that center punch of yours, I'm having mine dressed," and somehow that is the last you will ever see of that or any other tool that you loan him, unless you jog him about it, and then—"Oh, that's so, I forgot all about it." Verily, he is a fiend, and has made many a man resolve not to keep a decent tool in the shop, for fear that it will eventually find its way into the drawer of this shop abomination.

Did you ever see the man who imagines that the shop would go to smash if he wasn't there to look after things? He rushes about as though the whole concern rested on his shoulders, and he has that careworn look that would suggest that he was responsible for the outcome of all matters pertaining to the future welfare of everything and everybody about the place. He thinks that nothing has been done right, unless it was done at his suggestion. Poor fellow, I really feel sorry for him. I believe that many of these men are sincere in their beliefs, but it is only a delusion. They don't seem to realize that there isn't a man in the shop, or any other place, whose position could not be filled by some one else with perhaps greater efficiency.

There is the chronic crank who has a growl for every one; he is the terror of the apprentice, who is afraid of his swearing and abuse. So I might go on—the man who does everything with a rush, but somehow never gets through any sooner than the man who takes time to use his brain, and brings into his work ideas and contrivances which more than make up for his neighbor's expenditure of muscle.

The man who has a hobby, and who will talk about it whenever he can get any one to listen to him, "and a host of others."

CHARLES STELZLE.

Turning Shafting.

Editor American Machinist:

Concerning Passaic's inquiry in the issue of Dec. 31, relative to shaft turning, perhaps what I may say will cover some points regarding the operation as is usually done in average shops. Work of this nature requires considerable skillful management of the preparatory steps, which I shall try to explain further on. Before beginning such work, it is always desirable, if not absolutely necessary, to know for what purpose such shafts are to be used, so we may determine to some extent the degree of accuracy necessary. Accuracy of a job within certain limits is very cheap; beyond this, very dear; the reasons being well known, it is needless to discuss them. A fair straight job, or a *perfect* cylinder, represents two extremes, both in work and cost, and it even becomes a matter of considerable difficulty to locate the dividing line between them. What I have to offer relates more particularly to the process of manipulation of ordinary lathes in the production of commercially straight and round iron in lengths.

The guide rest Passaic refers to bears a similarity to the great majority, bad or indifferent, seldom good; it can be remedied somewhat, as will be shown. If it has a good tool-post we should be especially thankful; if there is a good hardened follower bush we should feel in deepest clover. The lathe tool rest is generally good for two tools, which advantage may be utilized on extra heavy cutting. It is well to observe, however, in the outset, that the accuracy of any machine job is much improved by a general roughening off or preliminary cut to remove the surface inequalities; especially is this true of such a susceptible thing as a long, slender shaft, whose truth in turning depends to a considerable extent on the influences surrounding the tool. It is the little influences in any mechanical operation that should be well looked after, lest they combine in one big one, and do irreparable damage later on.

An important thing in turning shafting is in the preparation. Carefully faced, centered and straightened, no matter if there is plenty of stock, it *ought* to be straightened. A little time spent in the beginning may bear good fruit in the end. Do not hammer a shaft, but bend it; when ready to commence turning, do not have the centers too tight; a shaft lengthens by being turned, as well as expansion by heat. If it stretches, it must go somewhere or be distorted, and distortion on this job means something. Never use a single-tailed dog to drive it; use a clamp, and see that each side does an equal amount of pushing. In the commencement turn a place round and straight as possible to start the rest on; let the bush fit without shake. Most all ordinary shafting rests are weak sidewise. If the bush fits snugly, as it should, it is very apt to cramp in a weak rest. To remedy this, run an iron brace from top of rest to the wing on the slide, and bolt it firmly. Good keen tools are a necessity—Mushet preferred—plenty soapy water makes them cut free. After a little experience at this work, feeds and speed may be increased enormously. If the shaft runs loose in the collar it will get eccentric, and in wind, and we can expect a bad job; if the shaft doesn't happen to true up it will be a worse one; the condition of the shaft running in the collar reproduces itself at the tools, and somewhat magnified.

Presuming the shaft has been trued by springing it on the centers, it will be found to run somewhat out of truth; this must be corrected by a subsequent straightening.

The correct appreciation of the influences and surroundings inherent in a little operation like this serves to divest it of much trouble and worry, and at the same time will serve greatly to secure uniform and fairly accurate work.

I do not know how these firms who make shafting a specialty turn them, and I think many of our readers who have measured and used it do not care to learn their methods.

However, the method may be all right, yet the work from some cause is, as the boys say, neither round, oval nor square. There is lots in this shafting business, and I expect it would take a good-sized book to describe the development of shaft turning, from turning on plain centers, the steady rest, the follower rest, shafting rest, cold-rolled, hot-polished drawn, down to the Morton Poole grinding, and each process with variations. At all events, we will try to save Passaic from the ultimatum—the yawning gap lathe.

L. C. SHARP.

English and American Locomotives.

Editor American Machinist:

In your issue of December 24th Mr. W. H. Booth comments on the neatness of English and American locomotives, somewhat to the disparagement of the latter.

The English locomotive is inside connected, without headlight, bell, extended front, and the sand box is under the wheel covers. The cab is simply a plate in front with low sides. The machine is covered with sheet iron, wheels and all, painted and varnished, and makes a very simple thing to clean, and can be kept looking very neat with but little labor. Constructed in this way, they will always look simpler and neater than is possible with the American style.

The machinery, however, is not, and cannot be kept as clean as the American with the same labor, for the reason that it cannot be got at. American engines at one time were inside connected, but became too expensive for our work. English engines also do not have a pilot to kick up dust, as obtains in American practice.

Mr. Booth speaks of the brick arch in the furnace as though it were almost unknown here, whereas it is in universal use.

The English people have another arrangement in their fire boxes that it would pay Americans to investigate, and that is a curved sheet-iron apron about two feet long, the curve being the same as the top of the door, and so arranged that it can be put in with a shovel, and it retains its place without any apparent support.

The furnace door is in halves, the bottom letting down, and when closed the top shuts down, and the top half is like ordinary window blinds, and admits sheets of air under the apron, that must be intermingled with the flame, as it is brought right into the center of it. It is apparently this, either instead of or in connection with the brick arch, that renders the combustion smokeless, and also there are very few sparks.

The coal they use is lump, and whether the same results would follow with our run of mine is possibly a question.

There can be no question of superior simplicity and neatness of the external appearance of their machines, nor the comfort that comes from the freedom from the smoke and cinder nuisance, but when one stands on the platform at London and sees two locomotives attached to a train that would be play for one American locomotive, and realizes that those locomotives must make from 70 to 80 miles per hour down hill, in order to make an average schedule of 50 miles per hour, he would realize there was chance for study yet.

When it comes to the question of one or two crews for a machine, we will suppose a case where 200 locomotives are employed and would be required by the single crew, and but 130 by the double crew system.

At $10,000 apiece, this would save in capital expended $700,000 in engines alone, without taking into account the extra real estate, buildings, etc

There is one thing in English railroading that calls for reform, and that is their abuse of the air-brake. Their locomotives are apparently heavy to secure sufficient traction with one pair of drivers, and the cars are light, and but two pairs of wheels under a coach, although very sensibly they are adopting the American swinging trucks. The brakes are set up so that all the wheels slide, and, of course, are covered with flat spots, and the consequent jolting is very annoying to those not accustomed to it.

W. E. CRANE.

New Use for Micrometer Calipers.

Editor American Machinist:

I have discovered another use of the micrometer which I think is original with my informant. My tool chest was open one day and an old machinist spied my micrometer lying in the case. He turns around with it in his hand and asks, "How many of these clamps have you?" I told him I had only one. He said, "You ought to have two. They are mighty handy tricks to clamp templates to pipe flanges and the like." Pretty expensive clamps, I thought, when I recovered consciousness.

I don't suppose he knows there is such a thing as the AMERICAN MACHINIST in existence. There are men who don't believe in learning a thing until they run against it. Another one had to cut a left-hand thread with a boring bar and fixed cutter. He couldn't reverse the lead screw, so he struck an idea and turned his cutter edge down and run lathe backwards. He couldn't understand why the work ran away from the tool instead of cutting a left-hand thread. He couldn't see any further ahead than the man did when he said he put a set of driving box brasses on a mandrel and turned them all at once. The only fault I find with the AMERICAN MACHINIST is the fact that it has only twenty pages. As somebody said, "It tastes like more."

A CHINIST.

Lubricating Planer Ways.

Editor American Machinist:

A few years since we built three planers, and we were much puzzled over how to lubricate the Vs, for none of the numerous devices seemed to be perfectly successful. Finally, we decided to cut a serpentine oil groove on each side of the *table* Vs, leaving the wearing surface of the *bed perfectly smooth*. This, as you are aware, is the reverse of the general practice. This year we had occasion to overhaul these tools, and although the bearings of the tables were not good, and the tables had been sprung quite as much as usual, there was not the faintest indication of cutting in either the rubbing or the rubbed surfaces, and we had never seen before planer ways in such perfect order after so much wear.

Probably this method of lubricating planer ways is not original with us, but of one thing we are quite certain, it should be generally adopted. For this reason we hope you will give it prominence in your valuable paper.

THE NEWARK MACHINE TOOL WORKS
(BINSSE & HAUSCHILD).

Reaming Cast-steel.

Editor American Machinist:

I would like to know if any of your readers are reaming cast-steel satisfactorily.

We have a number of pieces to make to a standard size, with holes 1″ to 1½″, and my experience with a reamer (inserted teeth), has been that it will cut good for about ½″, then start to tear and stick itself. Have used soda water, bolt oil and turpentine, and sometimes get one through without tearing.

A SANGSTER.

[Cast-steel has been reamed successfully for years, and in every shop where tools are made. The trouble is probably with the reamer used; and a solid reamer, or one with inserted teeth, in which it is certain that the teeth are held very rigidly, will solve the difficulty. Use lard oil.—ED.]

Some Experience with Gauges.

Editor American Machinist.

The December 31, 1891, issue of your paper contains an article—"Standard Measurements in Machine Construction"—which should prove interesting to all good mechanics, as it shows the practicability of precision gauge makers to furnish their gauges of so fine a limit of accuracy as $\frac{1}{10000}$″—some makers advertise this limit.

I have a number of these so-called fine measuring tools—paid good dollars for them, and believed that I had procured the best of the kind which the market afforded; and they were made by various parties who are prominently identified with gauge making.

These gauges are not worn by use, but have been preserved for reference purposes only; and comparisons of them with each other in many cases—even though said comparisons be confined separately to their separate make—show no such refinement of the arts as should be expected as respects precision.

I have frequent occasion to make tests of gauges—mostly micrometers—and notice that the gauges of the less pretentious makers are fully equal (if not better) than those of the "big folks" in this business.

These inaccurate gauges—all of them—bear their makers' names, and I should suppose that some of them would be ashamed to announce that the limit of accuracy of these gauges was their standard of precision.

I have a ¼″ plug and ring gauge which is in same condition as when purchased. The

male gauge I believe to be practically accurate; the female gauge is so much larger that the male gauge can be shaken when within it.

Another of this same make—a $\frac{1}{2}''$ plug and ring gauge — fit each other very perfectly, so much so that during my ownership of these gauges I have not thought advisable to pass the one through the other, all told, more than three or four times, as the operation is a critical one. This said $\frac{1}{2}''$ plug is more than twice the diameter of the $\frac{1}{4}''$ one to a considerable amount. Also twice the diameter of this $\frac{1}{4}''$ gauge is likewise larger than a 1″ gauge which I have and believe to be about correct.

I have many of each of several makes of gauges, and I have several means of proving them with each other.

I have two 2″ male gauges; one is an end measure gauge—*cost me six dollars*—I wish I could be satisfied that it was within $\frac{1}{50000}''$ of being 2″ long, and knew which way the inaccuracy extended.

The other 2″ gauge is made by another large concern, and it does not correspond with the first-named gauge. This first-named gauge I believe (?) to be accurate within the $\frac{1}{50000}''$, though the finish of its measuring faces is not what it should be.

All told, I have about $100 worth of these fine tools, which are certainly doubtful as to precision; others which I have I am confident of.

Many of my gauges are made by a "big party," who profess great accuracy, though they are very careful not to commit themselves by advertising their accuracy limit.

If all the popular gauge makers which I know of were to advertise that their gauges were accurate within $\frac{1}{20000}''$ (one twenty-thousandth inch) I think that their precision limit as they now are made would often be found on either side of this mark.

Most of the high grade precision gauges are sold at prices which certainly are sufficiently remunerative to warrant the makers maintaining a limit of error *not exceeding* $\frac{1}{50000}''$, and I am certain that the users of such tools have need for such refinement.

H. C. HECKENDORN.

Reading, Pa.

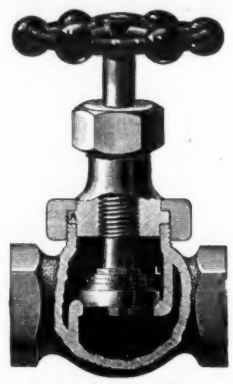
The Treatment of Steel.

Editor American Machinist:

I have read with care the very interesting letter of Mr. Severance, in your issue of January 3d, but fail to see why there should be any serious difference between us. Facts, natural laws, which govern results from use and treatment of steel, will be likely to remain the same, however we may differ on minor points.

Now as to compromise, *i. e.*, "giving up my notion about removing *all sorts* of articles from the cooling bath before thoroughly cooled, and adopting his *little treatise scheme* for classifying steel according to price." All on his side so far, take notice; what do I get in return? A pat on the back as "one who really knows." No, sir, we can't swap. Please don't understand me to say, "remove *all* articles from the cooling bath before thoroughly cooled." I don't do it; I don't think it necessary. But *some, a great many*, I would treat in that way, if not because necessary, at least because safer.

Let's skip over some other matter to answer the question, "Will I be kind enough to guarantee that a supposed piece of low-grade steel used for stamping coin will not *faint away* under the excessive pressure, if hardened by my method, *i. e.*, taken out of cooling bath before cold?" No, sir, I will not, nor would I guarantee the "old-reliable-good-for-everything steel" for coin stamping, hardened either by his method or my own. But I shall continue to believe, until some new evidence is put in, that my piece, taken out before thoroughly cooled, will be no more likely to "*faint away*" than the piece which remains until thoroughly cooled. I am looking forward with much interest to the time when we can get positive proof that pieces of any considerable



A NEW GLOBE VALVE.

size can be hardened to any considerable depth, or that *after steel has cooled gradually, or all but the surface must of necessity cool until below the hardening heat, it will be hardened to any appreciable extent by keeping in the bath until thoroughly cold.*

As to whether this be "quackery," or "cold fact," much may be learned by going at the inside of broken dies and other hardened pieces of steel with drill and chisel. Don't take my word for it; try it yourselves, and I have no doubt some—possibly Mr. Severance among others—will be surprised to learn how little real significance the oft-repeated statement, "hardened clear through" has.

In this connection it occurs to me to state, for the benefit of those who have not already learned the fact, that, after a piece is heated ready for dipping, such part as it is desirable to not have hard may be kept soft by clamping on a piece of cold iron or other metal before dipping, thus forcing that part to cool more gradually. In this way the holes in disks, liable to contract in hardening, may be kept soft and turned out instead of grinding. It is desirable sometimes to drill holes in hardened pieces after the hardening has been done, for the reason that to harden the pieces with the hole in adds to the danger of cracking in hardening. This is easily accomplished by covering the part to be drilled with a piece of cold metal before dipping. Take it out of the bath before thoroughly cold? does somebody ask. Do just as you please about it; the result will be practically the same.

Classifying according to price. How can that be done, with the fact before us that steel users are continually urged to use steel for tools which costs only three cents per pound—even less, and told that it is superior to higher-priced steels, while from that the price ranges up to 50 cents per pound, and somebody is using each extreme, while others use all the grades between? Has it not occurred to you, Mr. Severance, that there is really a better classification than that of price in the hands of manufacturers of steel, and one which they are very anxious to have the public take the benefit of? "*Bad luck*," "poor temperers," "more light." Strike out the first, as far as it is possible, by using no steel except such as is adapted to the work in hand, and then avoiding all improper treatment so far as possible. Improve by practice and observation. Get more light by adopting only the successful methods, rejecting all known bad practices, and by readiness to recognize the real facts, as they must necessarily force themselves upon the notice of all steel workers.

S. W. GOODYEAR.

Strength of Cast-Iron.

Editor American Machinist:

Reading Mr. Gowan's article in issue of December 31, 1891, reminds me of test made in June last from mixture of irons we used for a high-pressure crosshead casting weighing 1,400 pounds for a large horizontal compound engine. The irons used being:

21½ per cent. No. 1 X Foundry Pig-iron
35 per cent. No. 2 X Foundry Pig-iron
15 per cent. No. 1 Southern Pig-iron
3½ per cent. No. 1 Silvery Pig iron
25 per cent. Scrap—

which gave 34,500 pounds tensile strength per square inch, and a casting with close, even grain, easily worked, and took a splendid polish. Our every-day mixture gives a tensile strength of 26,000 to 27,000 pounds per square inch, without the use of scrap.

If this high strength can be obtained by using such a per cent. of No. 1 X Pig, and still have a casting which it is a pleasure to fit up in the machine shop, what strength can be had in a casting where no machine work or finishing is required?

W. H. C.

Boiler Explosions.

Editor American Machinist:

I notice in the AMERICAN MACHINIST of December 17, 1891, the large percentage of boiler explosions of thrashing machines, but never one word is mentioned about the style or kind of boiler, which, I think, is wrong.

The boilers we use on this coast are mostly arranged so as to use straw as fuel, and a great number of them are made of the Cornish type—a large flue from 22″ to 26″ in diameter, and from 7 feet to 9 feet long, and $\frac{1}{4}''$ to $\frac{5}{16}''$ thickness; diameter of shell is from 40″ to 46″, and thickness $\frac{1}{4}''$. Now the number of explosions of these boilers is very large. I heard one of the manufacturers of these boilers say, "Well, when one of my boilers blows up it kills only a few men, but whenever a J. C. Hoadley boiler blows up it will kill a lot of men."

I am on this coast twenty years, and heard from J. C. Hoadley himself that the number of thrashing engines he sent on this coast was over 600, and I have never heard of one of his boilers exploding; he manufactured a good, honest, substantial boiler.

Why don't our government inspect boilers used in the field by honest farmers the same as they do boilers used on ocean or waters? Why isn't a farmer's life worth as much as a sailor's?

FRANK X. FISCHER.

A New Globe Valve.

We present with this a sectional view of a valve which possesses some features of special merit. Instead of the bonnet being threaded direct to the body of the valve, it is merely fitted into it plain, and rests upon a flange which fits upon the upper edge of the opening, as shown. The bonnet is then secured by a nut which fits over the flange, and is threaded to the outside of the body of the valve, as shown.

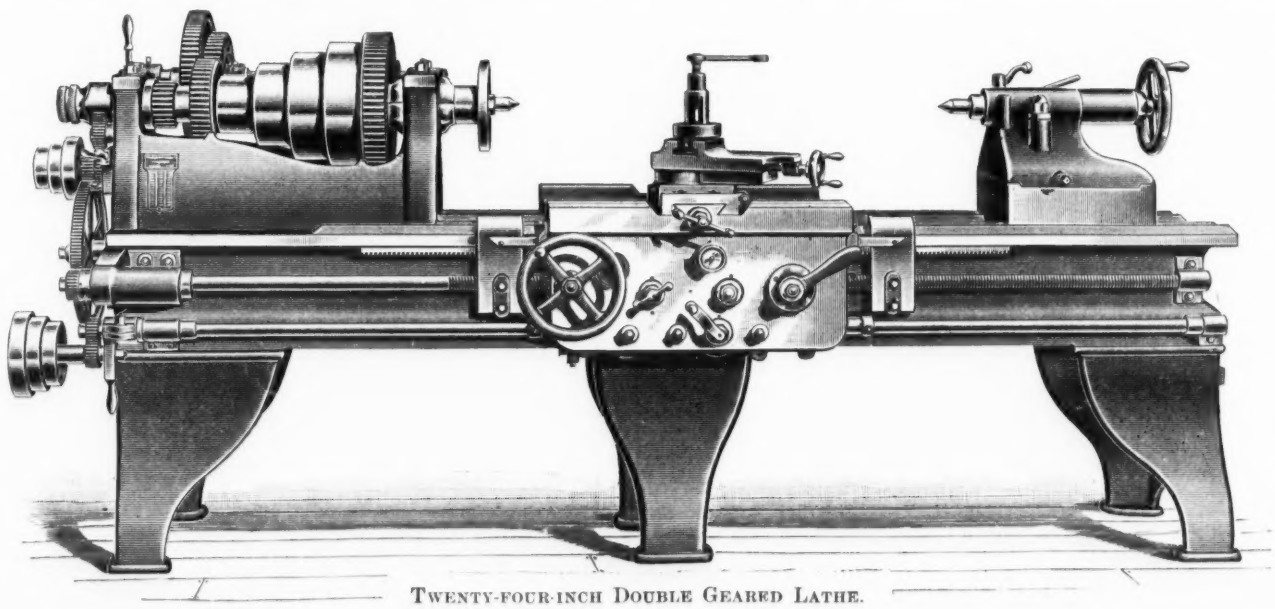
The result of this arrangement is that the valve can be re-ground at any time with the greatest facility, because all that is necessary is to loosen the nut, remove the bonnet, place sand under the disk, and then replace the bonnet, leaving the nut loose, so that the bonnet is free to turn with the stem during the grinding. A piece of wire is passed through a hole provided for that purpose in the lower end of the stem and the disk, so that the disk will turn with the stem during the grinding, which, of course, it does not necessarily do when the valve is in use. The bonnet, being in place when the grinding is done, effectually centers the stem and holds it in proper place, so that the grinding is done correctly. The valve can thus be readily ground while in position, and in many cases does away with the necessity for breaking connections. The disk is also, of course, easily replaced when required. The valves are made for the heaviest pressures, and are in use on many locomotives, steamboats, etc., and on cruisers of the U. S. Navy, where the requirements are very severe. The valves are made by the Lunkenheimer Brass Mfg. Co., Cincinnati, Ohio.

Twenty-four-inch Double Geared Lathe.

We give with this an illustration of a new lathe which has been brought out by Prentice Bros., Worcester, Mass.

The head has double back gears, by which, in connection with the other usual features, twelve even changes of speed are obtained for the spindle, from 4 to 280 revolutions per minute, the back gears being in the ratio of 4 to 1 and 13 to 1.

There is a steel spindle having a main bearing 2½″ diameter, 4½″ long, running in hard bronze boxes, and provided with a step for taking the end thrust, which is entirely independent of the box, being attached directly to the headstock.



TWENTY-FOUR-INCH DOUBLE GEARED LATHE.

The lower feed cone is adjustable, for the purpose of regulating the tension on the feed belt, or for using change wheels, by which any desired range of feeds may be obtained. Feeds are reversed in the apron of the carriage, and can be thrown out of gear when chasing screws. There is an automatic stop for the carriage, which is useful in turning duplicate pieces to a shoulder. There is an automatic feed and a clamp for clamping the carriage to the bed when using it.

In each leg is a receptacle for gears, tools, etc. The countershaft has improved hub, noiseless friction pulleys and clutch.

Lathes of 14″, 16″, 18″ and 21″ swing are made of the same design, with plain gibbed, rise and fall, or compound rest, or with taper attachment and any desired length of bed. The 24″ lathe with 12-foot bed gives 7 feet 2″ between centers, and weighs 4,200 pounds.

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J. G. A. MEYER, } Associates.
FRED J. MILLER, }

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☞ *Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.*

☞ *We are not engaged in procuring patent rights, or in selling machinery, nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draftsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

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NEW YORK, FEBRUARY 18, 1892

CONTENTS.

PAGE

Toggle Joint Drawing Presses.... 1
Fourteen-inch Turret Lathe.... 1, 2
Jacket Cores for Molding Steam Cylinders. By S. Bolland.... 2, 3
Designing New Machinery. By Henry B. Morris.... 3
Interviewing an Engineer.... 3
Rubber Pattern Work. By John T. Usher 4
English and American Locomotives By W. H. Booth.... 4, 5
Letters from Practical Men: Planing Irregular Forms. By A Mechanic ...Foundation for Drop Hammer. By Wm. Newton....Machine Shop characters. By Charles Steizle ....Turning Shafting. By L. C. Sharp....English and American Locomotives. By W. E. Crane .. New Use for Micrometer Calipers. By A Chinist...Lubricating Planer Ways. By The Newark Machine Tool Works....Reaming Cast-steel. By A Sangster ...Some Experience with Gauges. By H. C. Heckendorn .. The Treatment of Steel. By S. W. Goodyear ... Strength of Cast-iron. By W H. C. ..Boiler Explosions. By Frank X. Fischer.... 5, 6, 7
A New Globe Valve.... 7
Twenty-four-inch Double Geared Lathe.... 7
Protection of Secret Processes.... 8
Some Natural Gas Experience.... 8
The Steel Beam Trust and Prices.... 8
Literary Notes.... 8
Questions and Answers.... 9
Equalizing Work Within Fixtures. By A. D. Pentz.... 9, 10
Manufactures.... 10, 11
Machinists' Supplies and Iron.... 11

Protection of Secret Processes.

A case of considerable interest to manufacturers and their employes seems likely to be that in which a Rochester firm of photographic supply manufacturers seeks to prevent ex-employes from forming a company to go into a similar business of manufacturing, on the ground that they propose to use in the interest of the new company information regarding secret processes which is not rightfully their property, and that the formation of the new company amounts to a conspiracy against the business interests of the older company. A temporary injunction has, we understand, been granted. Of course we are not sure that all the circumstances that should be taken into consideration have been given in the published reports, but it does not seem to us probable that a permanent injunction will be granted in any such case. The government offers in the patent office such security as it seems practicable to give for trade secrets, and if such a principle as seems to be involved in this case were sustained by the courts and carried to its logical conclusion, it would probably prove to be one of the greatest obstacles to industrial progress and development that has ever been devised. A man's experience gained in his daily work is one of the things which he works for, and which makes his services valuable both to himself and to others. If he could be effectually prevented from making any use of this experience or knowledge, except in the service of the employer in whose establishment it was gained, that would not only be a bad thing for the man, but it would be a very bad thing for the people generally, for there could be very little progress and very little incentive to profit by experience or to improve by it. Under such conditions, workmen would take employment understanding that any additional knowledge or experience gained by them would be available only while working for the same employer, and the employer, also knowing this, would, of course, refuse to consider the question of increased pay, because he would have a practical monopoly of the services of the employe, and could retain his services practically upon his own terms.

Of course, it will seem to a manufacturer to be unjust that new processes of special value originated or developed in his establishment may become public property and be used by his competitors; but if the courts could and did effectually prevent all apparent injustice of that kind, the diffusion and development of technical knowledge would be completely arrested. Nearly all processes which are of any value are patentable, and the government will protect the inventor in the exclusive use of them for a definite term of years, on condition that he fully reveals and explains them in such a manner that, at the expiration of the term of the patent, any one who desires may make use of them. It is not at all likely that the courts will grant perpetual protection in the exclusive use of such processes, without any conditions whatever.

Some Natural Gas Experience.

About two years ago the manufacturing cities of Dayton and Springfield, O., were piped for natural gas, the pipes being owned by a private corporation which brought the gas from a distance of about fifty miles. This done, the manufacturers and citizens generally of the two cities supposed they had secured practically all the advantages which they would have derived had gas been found in their immediate locality. But for some time past the pressure of gas in the pipes has been falling, and with this fall has also become very unsteady—so much so that it seems it is not to be depended upon, the gas company itself warning users that the fires must be constantly watched, for fear a very low pressure might allow them to be extinguished, after which unconsumed gas might flow into the building and result in asphyxiation or an explosion. When the franchise for pipe laying was granted the maximum price of gas to users was stipulated, and the company has been claiming that, because of the failure, the price should be increased, probably to cover the expense of bringing it from more distant fields, though this point is not made clear by the local papers, so far as we have noticed. At any rate, there seems to be a strong public sentiment against the way in which the gas company has carried on the business, the latest result of which is an order by the municipal authorities of both cities requiring the company to shut off the gas and discontinue the service.

Since an unlimited number of competing companies cannot lay pipes in the streets of a city for furnishing natural or any other kind of gas, it would seem to be the part of wisdom for manufacturing cities who wish to hold out inducements to manufacturers, to own and control the pipes within their own streets, and then either contract for the supply of the gas through these pipes upon the best obtainable terms, or buy it direct and supply it, as in the case of water in these same cities—at or near cost. If the gas companies cannot fulfill their contracts in these cases it would seem to be a good opportunity for the municipalities to acquire control of the pipes at a fair valuation, and thus secure for private and manufacturing uses the fullest possible benefits to citizens.

Prof. Orton's views of the permanency of the natural gas supply are being sustained by the course of events; but it does not seem improbable, in view of what is known regarding the cost of gas manufacturing, that a manufactured gas may yet be furnished, which, for many purposes in manufacturing and for domestic use, may surpass any other fuel in economy, all things considered. Such a fuel gas will be the sooner developed, we think, if municipalities own their own systems of piping and receive competitive bids for supplying them with gas.

The Steel Beam Trust and Prices.

The defenders of trusts have contended that only by the formation of trusts could the greatest possible economies be introduced in the production of goods, and that trusts, by doing away with the expense resulting from competition, could supply goods lower in price than they could possibly be furnished by concerns actively competing with each other. So far in their arguments most of those who are familiar with manufacturing processes have agreed with them; but they have gone further, and declare that trusts would and did sell their products at lower rates than competing firms could. Just here there has been a hitch between the special friends of trusts and those who are not their special friends; the latter, while acknowledging that goods might be produced more cheaply with given methods of manufacture if there were no competition, denying that the goods would be sold as cheap, or, in fact, any cheaper than found to be necessary for reasons outside of home competition.

The latter view of the case seems to be sustained by the fact that the recent collapse of the steel beam trust resulted in an immediate fall in prices. The use of steel beams in buildings has been constantly on the increase for some time, in spite of the unfair price at which they have been sold for some years by the combine, and it seems now not improbable that the use of them will very largely increase with the coming spring's building operations. If so, this ought to have a favorable influence upon the machine business. It is thought that prices will at least be kept so low by the larger and better equipped mills that the smaller ones, and those which have not kept fully up to the times in the way of improvements, will find it impossible to compete. This—though it will be rather hard on the small mill owners—will give the public a share of the benefits of the latest improvements in mill machinery.

The Supreme Court of the State of Michigan has just handed down a decision which will be of interest to manufacturers and their employes. James Rowley brought suit against Victor and Frank Colliau, the Detroit manufacturers of cupolas, for the loss of an eye, the sight having been destroyed by a flying piece of steel from a sledge hammer which was being wielded by a fellow employe, Rowley holding a punch, which was being driven by the hammer. It was proven that all the other hammers in use in the shop were in good condition, and that an inspection would probably have failed to show that the one which did the damage was defective. The defendants kept a man employed whose business it was to keep tools in order; and the plaintiff, being an experienced workman, knew that hammers were liable to spawl off in use, and that he could choose any one of a number of hammers.

Where it is proven that shop proprietors do not keep tools in proper order, and especially in a case where complaints are made of the condition of a tool previous to the occurrence of an accident, the recovery of damages in the courts is almost certain; but this seems to have been a case in which the proprietors had taken all ordinary precautions, and that the accident was nothing more than is liable to occur at any time, in spite of all possible precautions that can be taken against them.

We have received a pamphlet giving some account of the School of Electrical and Mechanical Engineering, at the Alabama Polytechnic Institute, Auburn, Alabama. The school was established in June, 1891, and offers to students opportunities for studying the sciences named under the direction of Prof. A. F. McKissick, A. M., in the electrical, and Prof. J. J. Wilmore, M. E., in the mechanical engineering course. Prof. Wilmore writes us that during the past year a machine shop was built, and the school is now in such shape that he hopes to be able to do some good work in the instruction of students. There is no charge for tuition in either of the courses.

Literary Notes.

A PRACTICAL HAND-BOOK OF ELECTRO-PLATING. By Edward Trevert, author of "Everybody's Hand-Book of Electricity," "Experimental Electricity," "Electricity and its Recent Application," etc.

This little volume of 67 pages of reading matter, including a few illustrations, is intended, as stated in the preface, for the use of beginners and amateurs. No doubt the author is familiar with the subject, but he has not the faculty of interesting a beginner. The book seems to bear evidence of being hastily written, and the information conveyed is not of such a practical character as one might expect from the title.

The book is published by the Bubier Publishing Company, Lynn, Mass. Price, 50 cents.

Those of our readers who are interested in University Extension, and wish to know what has been done by the State of New York in that line, may have mailed to them pamphlets telling all about it by addressing the University of the State of New York, Extension Department, Albany, N. Y. This was the first State to make the university extension idea a part of its regular educational system, and the experience which has been gained in the work ought to be useful in other States which are or are likely to be interested in the movement. The department issues regular bulletins, and also pamphlets explaining the extension work, and giving hints for the organization of "extension centers."

The pamphlet of Mr. Alfred R. Wolf, M. E., on "The Ventilation of Buildings," has reached the second edition. Mr. Wolf has made a special study of this matter of ventilation and heating of buildings, and his pamphlet is a valuable one to all who are interested in the subject of ventilation, as, of course, every one ought to be. It contains information which every one in any way responsible for the sanitary condition of build-

ings should be acquainted with. It is published by the author at 315 Potter Building, New York City. Price, 25 cents.

Mr. Delmore Elwell is now in charge of the eastern headquarters of the Columbian Exposition, Mr. Anderson having resigned that position. Mr. Elwell has been connected with the office since it opened (in the Stewart building, corner Broadway and Chambers street, this city), and is familiar with the work connected with it. He will be glad to answer any inquiries which may be addressed to him by intending exhibitors or others in this part of the country.

QUESTIONS AND ANSWERS.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(56) H. C., Brooklyn, sends us a solution of an equation and asks us to point out wherein it is incorrect. *A.*—The equation, as stated, reduces at once to $6 = 6$, and needs no further computation.

(57) A. H. M., Shippensburg, Pa., writes: Please inform me through your columns how to test the horse-power of an engine by means of friction brake and scales. *A.*—See our issue of March 8, 1884.

(58) A. C. M., Buffalo, N. Y., writes: Please state where I can obtain a good book on brass molding—one that went into mixing metals more than anything else. *A.*—Practical Brass and Iron Founders' Guide, by J. Larkin, is considered to be a good book. It is published by Baird, Henry Carey & Co., Philadelphia, Pa., but it can also be obtained from any dealer in scientific works.

(59) W. J. D., New York, writes: Kindly give me through your Question and Answer columns a formula for finding the horse-power of a compound engine; or, in other words, a formula for getting at the steam pressure in the high and low-pressure cylinders as a basis for calculating the horse-power. *A.*—See our issue of September 10, 1891, and other articles treating on compound engines, by James Tribe.

(60) A. B., ——, writes: I want a furnace to heat a crucible hot enough to melt brass and use oil for fuel. Will you kindly give instructions how to arrange the furnace, or tell us where we can get them? *A.*—We do not think you can profitably rig up such a furnace yourself, but would do better to buy an apparatus for the purpose. You will find illustrations of oil-burning devices in our issues of April 7 and 14, June 16, 1888; Oct. 17, 1889.

(61) A. A., Brooklyn, N. Y., writes: I have a small engine, and would like to know what power it can develop. The cylinder is 1 inch diameter; stroke of piston, 2 inches; number of revolutions per minute, 820; boiler pressure, 60 pounds. *A.*—We should estimate it at $\frac{1}{8}$ of a horse power. 2. How do you compute the horse-power? *A.*—See answer to Question 156, in our issue of April 2, 1891. 3. Please state what books would be profitable to read to learn the construction of steam engines and boilers. *A.*—See article treating on What to Study and How to Study, in our issue of February 19, 1891.

(62) W. M. K., ——, asks: What is the best method of finishing small brass castings that are not to be turned or planed? *A.*—By grinding on emery or corundum wheels. 2. What material can I use to put the finest and most durable polish on them? *A.*—It depends upon the method adopted. If you use polishing wheels, you may use crocus or rouge, or a rag wheel without anything upon it. Durability of polish depends more upon the quality of the metal itself than upon anything else, unless it is lacquered, as it should be if the color is to be retained.

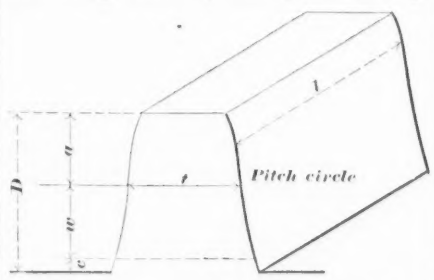
(63) J. H. B., ——, asks: What is the best time made boring, facing and counterboring a 17"x24" locomotive cylinder? *A.*—We do not know. 2. It is claimed that a file should never be used on a lathe job, that it is unmechanical and does not make a good job, is not economical, nor allowable under any circumstances. Is this true? *A.*—No, we do not think it is true. Files should be used on lathe work less than they are, for they are used in many cases where there are better ways of finishing, but there are circumstances in which the file is entirely proper. The best workmen are governed by judgment and experience in such matters as cases present themselves, not by any hard and fast rules.

(64) A. H. F., New York, writes: Some years ago I had to make a set of three $\frac{3}{4}$" dies for a Joshua Heaps bolt cutter. I fitted the blank dies to the head, and cut the thread with a hob having the required number of threads per inch (11), but being about $1\frac{1}{4}$" diameter. After finishing the dies, I found that when they were closed on a $\frac{3}{4}$" bolt, they cut a finer thread than that on the hob. Will you please explain why? I claim that the difference in the angle of the spiral of the thread caused it. *A.*—It is difficult to say certainly just what the cause may have been, but the hob was entirely too large, and this may have contributed to the bad result.

(65) C. E. K., ——, asks: What decimal part of the pitch of a gear is the length of tooth; also the thickness of tooth that will be accurate in sizing blanks? I have B. & S., Warner & Swasey, and another old catalogue, but they do not agree. *A.*—There is no fixed rule for this, each maker of gears or of cutters for them being guided by his own judgment and experience, of course, within reasonable limits. For cut gearing, the working depth is almost always twice the diametral pitch, and the additional depth given for clearance varies. 2. What number of degrees makes the greatest angle in a circle? *A.*—We do not understand your question. 3. Where is the pitch line on a worm gear that is hobbed? Am I correct in thinking that the pitch line is the same as in spur gearing? *A.*—You are correct in one sense. The pitch line is at half the working depth of the teeth, but the blank may be sized to have the pitch line at the center of the face of the wheel or at the edge, or between the two, as preferred.

(66) C. D. K., ——, asks: 1. Do you know who originated the form of tools known as wheel tools, which are used on the cutting-off slides of screw machines and elsewhere? *A.*—We cannot give this information. It is probable that that form of tool was used to some extent many years ago. 2. Can you give me a description of the way in which Brown & Sharpe's patent cutters, which can be sharpened without changing their form, are backed off? *A.*—They are revolved upon an arbor, the same as in the lathe, while a tool of the proper form for shaping the cutter, and held in much the same manner as the ordinary lathe tool, is moved back and forth to and from the cutter in such a way as to back off the teeth. This movement is secured by a rotating collar which is placed upon the cross-feed screw, this collar having cam faces which engage with similar cam faces upon a stationary collar, thus giving to the screw, the cross slide and the tool, a reciprocating motion. The relative speed of the rotating collar is made to suit the number of teeth in the cutter to be backed off. 3. Is there any work published which treats of automatic screw machines? *A.*—We know of none. 4. Where can I get the last edition of the Master Car Builders' Dictionary? *A.*—By addressing the Secretary, John C. Cloud, Rookery Building, Chicago.

(67) E. D. G., Philadelphia, Pa., writes: Please give me through your columns the information relating to the following: What will be the dimensions of a tooth of a gear wheel (cast-iron) to resist a force of 1,000 pounds? It is to be used on a winch, the load being raised by man power through



the medium of cranks, so the number of revolutions of the driving gear will not be more than 30 or 40 per minute. Please give full and explicit formulæ. *A.*—In slowly moving gearing, especially in gearing worked by hand and not subjected to much vibration or shock, the following formula is often used for computing the pitch:

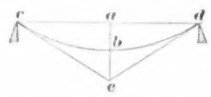
$$p = .04 \sqrt{P} \qquad (1)$$

In which p denotes the pitch in inches, and P the total force transmitted by the wheel. Hence in the case here given the pitch will have to be:

$$p = .04 \times \sqrt{1{,}000} = 1.26 \text{ inch.}$$

For obtaining the dimensions of other parts of the tooth, the following rules may be adopted. Multiply the circular pitch by .3183; the product will be the addendum a (see figure). Thus: $1.26 \times .3183 = .401+$, say $\frac{4}{10}$ of an inch for the addendum or face of the tooth. The working part w of the tooth is equal to the addendum, and the clearance c is equal to the circular pitch multiplied by .05; hence the clearance in this case will be $1.26 \times .05 = .063$ of an inch; and the total depth D of the tooth will be $.4 + .4 + .063 = .863$ of an inch. The length l of the tooth is usually equal to twice or $2\frac{1}{2}$ times the pitch. The thickness t of the tooth is equal to one-half of the circular pitch minus a small amount for clearance and inaccuracy in workmanship. These are arbitrary rules, and they are sometimes changed by designers.

(68) C. A. H., Hamilton, Canada, writes: Kindly give an answer to the following question: Suppose a wire rope weighing .45 pounds per foot is strung over a distance of 400 feet, what would be the tension in the rope at the points of support? Kindly give me an approximate rule for working out a problem of this nature, and state it in the simplest form, so that I may readily understand it. *A.*—Let $c\ b\ d$ be the curve formed by the rope, and assume this curve to be a parabola. Let $c\ d$ be the span = 400 feet; $a\ b$ (perpendicular to $c\ d$) the deflection = 6 feet. Prolong the line $a\ b$ to e, and make $a\ e$ equal to 12 feet, that is, equal to twice



the length of $a\ b$; join c and e by a straight line; the line $c\ e$ will then be a tangent to the parabola. Now let $a\ e$ represent one-half the weight of the rope = 90 pounds, then the tension in the rope at c will be as much greater as $c\ e$ is greater than $a\ e$. To find the length of $c\ e$, add the square of $a\ e$ to the square of $c\ a$ and extract the square root from the sum. This gives us

$\sqrt{200^2 + 12^2} = 200.3$ feet for the length of $c\ e$, which is $\frac{200.3}{12} = 16.7$ times longer than $a\ e$; therefore the tension in the rope at c is $16.7 \times 90 = 1{,}503$ pounds. This method can be stated in symbols. Let S denote the span; D the deflection; W one-half of the weight of the rope; and T the tension in the rope at the point of support. Then we have

$$T = \sqrt{\frac{(\frac{1}{2}\ S)^2 + (2\ D)^2}{2\ D}} \times W.$$

This formula is based upon the assumption that the curve formed by the chain is a parabola, which is not strictly correct, but the results obtained by the formula are near enough for all practical purposes.

(69) S. A. M., ——, Iowa, writes: We have a 12 horse power engine and a 15 horse-power vertical boiler to furnish power for a machine shop which on an average needs about 3 or 4 horse-power. Our water supply is drawn from a drilled well in limestone, 500 feet from the river, and 10 feet above. We fear the water will scale our boiler so that we will have to stop using the water. Would it be advisable to put in a large tank and run the exhaust pipe back and forth across the bottom, condensing the exhaust steam which could be again used to supply the boiler, the deficiency being made good with what falls on the roof of our shops, 30 feet by 60 feet? If you can suggest a better plan you will greatly oblige us. *A.*—Your arrangement will not work. If it is necessary to change the engine to a surface condensing engine, we should advise to use an independent condenser, air-pump and circulating pump; there are several types of independent condensers and pumps on the market. Of course, to use these you will need a sufficient supply of cold water near at hand. But it seems to us hardly necessary to change the engine to a condensing one; we should use a suitable feed-water purifier, so as to purify it before entering the boiler; this will prevent injurious effects in the boiler. The water from the roof may contain matter which is hurtful to the boiler. 2. Our steam pressure is 60 pounds; exhaust pipe, $2\frac{1}{2}$ inches diameter; steam, $1\frac{1}{2}$ inch diameter. Suppose the temperature of the water in the tank is 75 degrees, the dimensions of the tank being 10x10x5 feet, how much exhaust pipe will we need in the tank? *A.*—We cannot answer this correctly without knowing the terminal pressure in the cylinder. You may need 30 feet of $2\frac{1}{2}$-inch pipe. 3. Will a tank of that capacity keep the temperature of the water so as to condense the exhaust steam for 10 hours, leaving 13 hours to cool in every night? *A.*—No; to keep the temperature at 75 degrees, a constant circulation of cold water will have to be kept up. 4. What per cent. of the feed water will we obtain from the exhaust steam? *A.*—If there are no leaks, and other waste, or use of the water in the boiler, the exhaust steam, when condensed in a surface condenser, will give a full supply of feed water. But since leaks cannot be altogether avoided, and since the boiler has to be blown off occasionally, you will need a small supply of fresh water; the exact percentage of this we cannot say without knowing more of your plant.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Grant's new 1892 Gear Book. See page 20.

Link-Belting and Sprocket Wheels.
Send for Catalogue of Link-Belting.
Over 50,000,000 feet of Link Belt in use.
Link Belt Engineering Co., Philadelphia and N.Y

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Forming Lathes, Mer. Mach. Tool Co., Meriden, Ct.

Ideal Drawing Stands. W. S. Rogers, Troy, N. Y.

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Selden Packing for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N.Y.

Our Automatic Gear Cutting Machine will increase production 50%. The Superior Mach. Wks., Clev'd, O.

S. A. Smith, 23 South Canal Street, Chicago, Ill. agent for Holbrook's Raw Hide Blanks for Gears.

Save small iron from foundry refuse. It pays Use the Woodruff Pat. Separating Machine, Audubon Machine Works, New Haven, Conn.

"Roper's Hand books for Engineers and Firemen." Descriptive Catalogue mailed free to any address. Edw. Meeks, Pub., 1012 Walnut St., Phila., Pa.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys Yocum & Son's Shafting Works, Drinker St., Philadelphia, Pa.

S. W. Card & Co., Mansfield, Mass., make everything in the line of Taps and Dies. S. A. Smith, 23 S. Canal St., Chicago, Western Agent.

Most sensitive and durable Damper Regulator made; works within one pound. Send for circular. T. Kieley, 11 W. Thirteenth Street, New York.

For the Latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson St., Chicago, Ill.

25", 32", 37", 42" — "Only Drill Press built on 'Ko-rekt' principles, Even if they come from Jersey." Gould & Eberhardt, New Ark, N. J.

Complete treatise on Screws and Screw-making, with clear and concise explanation of the methods; 95 illustrations. Price, $1.25 postpaid. E. & F. N. Spon, 12 Cortlandt St., N. Y.

Patent Soliciting of High Class.
D. Walter Brown, Counsel in Patent Cases.
31 Nassau street, New York.
Send for Brief History of Patent Legislation.

De Lamater Screw Propeller Wheel, made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

"Binders" for the AMERICAN MACHINIST. Two styles—the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. American Machinist Publishing Co., 96 Fulton St., New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2 postpaid. Published by John Wiley & Sons, 53 East Tenth Street, New York.

Equalizing Work Within Fixtures.

BY A. D. PENTZ.

I am glad to get the improved method suggested by "Bell Crank," of inserting hardened centers in the ends of cast-iron arbors, but at the same time desire to ask him if he finds enough merit in such arbors to make it desirable to produce them at an expense for time consumed in fitting the centers which would equal the extra cost for tool steel arbors through and through.

> Time and tools, shop and power
> Come to fifty cents an hour

in most places.

At this rate three hours' time would buy nine to fifteen pounds of good tool steel, and either of these weights would produce a large arbor. Cast-iron makes a better arbor than it would seem to, but it is not to be compared to steel at the same price. I will be pleased to get a very cheap and good method of putting hardened centers in cast-iron arbors, as frequently they are convenient things to make. The way the centers are shrunk in is not costly, but there might be a cheaper way found. One of these nights I will set forth what my experience with various materials for arbors has been. I am far from being orthodox on many points in arbor dogma.

In a previous article I threatened to give another equalizing milling fixture of a different construction from one then shown, and here it is.

The idea indicated in these figures is that, where it is possible, the weight of a piece should equalize it on its seat so that it shall lie on each of the supporting points with nearly equal weight. It is never my idea to *design* in illustrating an article for publication, but rather to indicate means that seem to me to be good in practice, or those which I have found to work well in my experience; and if the suggestions are accepted it is not presumed that they will be used in the precise forms in which they are shown.

In Fig. 1 is indicated a casting *X*, which may be seven by nine inches on the flat side, which is to be milled over its entire surface. It is evident that this piece must be secured to its fixture either by its round edges or by the two ribs *W*. It is possible to fasten it well at either of these places, but the purpose in view makes it desirable to use the round edges for this purpose. The thickness of the plate should be not less than one-half inch, and the defects of the foundry mold parting should be entirely removed from the edge before it is put in the fixture.

In the fixture, Fig. 2, this plate *X* is shown in the section through *Y Z*, but the plan view of the complete fixture above is empty.

The body *G* of this fixture is a casting planed on its six sides. The steel rocker *A* is fitted freely to a deep parallel groove near one end of it. It is the fitting of this kind of rocker, and its general arrangement, which enables this fixture to equalize its load.

The bolt *B* passes through and supports the rocker when it is unclamped. It fits the rocker very loosely—exaggerated in the section—so that it can vibrate on it about as freely as on a scale edge. This bolt, with its nut *B'*, is arranged to also clamp that part of the body marked *L*, when necessary, against the rocker *A*, and thus secure it as in a vise.

It is to be understood when the nut *B'* is released that the jaw *L* will spring open slightly and free the rocker *A* from all side friction, and then that a very slight pressure on either of the supports *K* will depress that particular support and elevate the one on the other end of the rocker. This rocker should be so sensitive and so well in balance that one ounce will make it oscillate noticeably. The jaw *L*, and that side of the rocker *A* next it, should be so fitted to each other that the clamping effect of the bolt *B* will secure the rocker as rigidly at its ends as in the middle. The best way to effect this result is to make the rocker about three-thousandths of an inch thinner in the middle than at the ends, and leave its groove parallel as planed.

The fixed jaw *C* is secured to the rocker *A* at an angle such as is found best to cover the rounded edge of the plate *X* to resist the opposing thrust and depress it against the support *K*.

The clamp jaw *F* is also attached to the rocker *A* at the same inclination. It is provided with a short foot *F'* to raise the remainder of the clamp away from the rocker, so that it can secure pieces of work of slightly variable widths. A bolt and nut is probably a better construction for repairs than the screw *E*, but they are more difficult to put in at first. The hole tapped for *E* could be enlarged and bored through, and a seat cut for the bolt head in the under side of the rocker.

The rockers *R* and *S* fit the grooves made for them precisely as the rocker *A* fits its groove. They are supported on the bolt *T* as *A* is supported on the bolt *B*. They may freely move when unclamped, and must then be in balance. The work clamps, *P* and *Q*, are duplicates of the clamp *F*.

The bolt *T* passes entirely through the body *G*. The slot *G'* is made to admit the bolt *B* to its place, and the collar *U* of a length to snugly fill the slot *G'* is placed on the bolt, to prevent the contraction of this slot by the action of the nut *V*. The jaws *R* and *S* when the nut *V* is tightened will clamp the rockers *R* and *S* as firmly as desired.

The stop *N* is screwed on the jaw *R* to locate the piece *X* in the setting, but it has no duty to perform afterward. The stop *M*, on the contrary, receives the thrust of the cut.

The depressions *O O* are made in the body *G* to accommodate the ribs *W*, *W*, on the piece *X*. It is clear that the rockers *R* and *S* must also be cut away to clear these ribs, and this will help to compensate for the overweight of the clamps *P* and *Q* in the balancing of these rockers. Other ribs could easily be accommodated in this fixture, or the distribution of the rockers could accommodate other arrangements of ribs or other protuberances of almost any form or locations.

Either of the clamps *F*, *P* and *Q* may be swung on its screw if it interferes with the admission of the piece *X*. When this piece is in place on the six supports, and pressed by the hand against the stop *N*, the fixed jaw *C* and the stop *M*, each one of these six supports *K* will receive such part of the weight as its location places upon it. If the support on one end of a rocker comes into contact with the surface of the piece before its fellow on the other end strikes, it will retreat downward until they are in equal contact. The rockers *A*, *R* and *S* are, as a whole, upheld on three points by the bolts *B* and *T*, and all the benefits of the three-point rule are retained, at the same time each of these points is doubled without adding a single rigid support beyond the three necessary ones on the bolts *B* and *T*. Thus are obtained six supports on three points. Additional supports *ad infinitum* can be had over three points, as will hereafter be shown.

When the piece *X* is in place against its stops and upon all the six supports, the nuts *B* and *V* should be set down very tightly, so as to clamp the three rockers securely, and beyond a doubt, that they may not be moved by stress of the cut. It will be noticed that clamps as here arranged have no tendency in tightening to disturb the rockers they fasten, but operate only to fix them rigidly in the position to which they are adjusted by the supported piece.

The clamps *F*, *P* and *Q* should next be *tightened lightly* in the order named, and then secured by a second operation in the same order as rigidly as necessary, after which mill the piece.

While I have a great reluctance in recommending just where under a piece of metal it shall be supported to withstand a cut, it seems to me that the six points under the piece *X* will be as well placed as can be determined before a trial. It would be a marvelous piece of thin cast-iron that did not relax when one side has had the scale removed, and no one cut on the flat side of the piece could be relied on to produce a satisfactory plane. Perhaps a second cut in the same fixture would do as well as any other milling operation to finish with; but I should advise that such a surface be lapped if great accuracy were desirable.

To indicate in some degree the extent to which the rocking principle can be applied to the equalizing of supports under pieces liable to be injured by yielding to stress, I have sketched a number of forms in which this device may be applied.

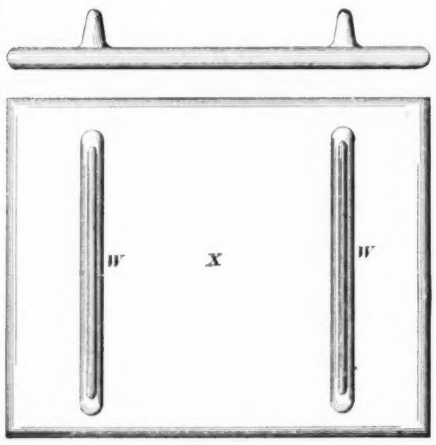

Fig. 1.

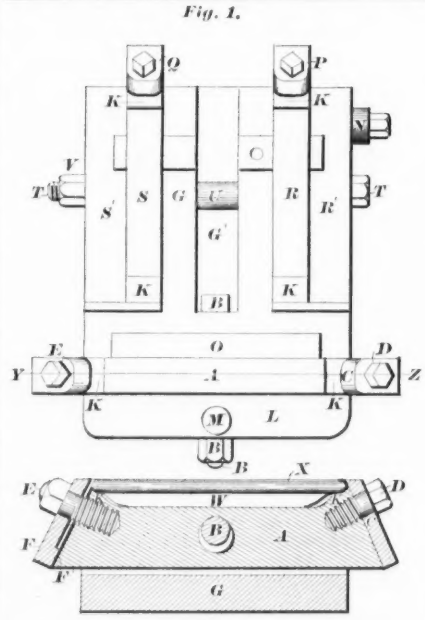

Fig. 2.

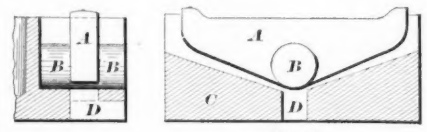

Fig. 3.

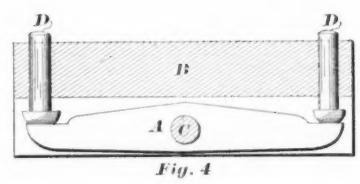

Fig. 4.

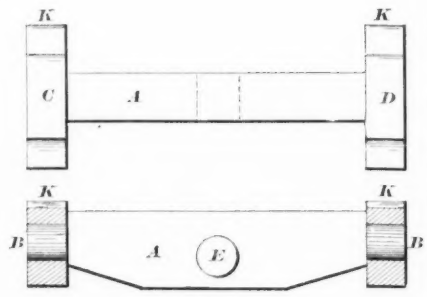

Fig. 5.

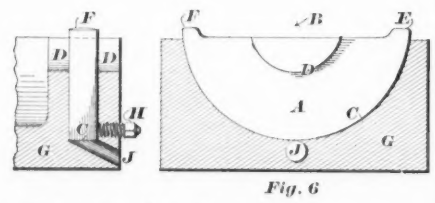

Fig. 6.

EQUALIZING WORK WITHIN FIXTURES — SEE PAGE 9.

Fig. 3 shows the rocker *A* mounted on the trunnions *B*, and arranged to be freely lifted out of its seat in the body *C*. This device could be mainly cast to go together without fitting. Its use would be to equalize the support under an area like a large surface plate, where three points of contact might not be enough and six would suffice to prevent sag.

In Fig. 4 the rocker beam *A* is attached to the bed or body *B* by the stud *C*, and equalizes through the poppets *D*, *D*. It would be useful in a fixture like that shown in the former article, or in fact in a fixture having six supports. The poppets may be clamped rigidly in many ways.

The method of equalizing a surface on four supports over one point, or on twelve over three, is set forth in Fig. 5. This may be extended to any degree. Three supports over one point or eight is as practical as is this arrangement. Care must be had, however, to clamp the pieces that come into direct contact with the work after it is equalized rather than the prime rocker.

Fig. 6 shows a very rigid rocker which would be applicable to planer work of great weight and considerable rigidity. The sketch explains its operation. The bearing may be either on the circumference *C* or on the partial hub *D*.

I would like to see a planer of reasonable length and some weight supported on rocking equalizers thus: One on each side from the housings *back* to the end of the bed; each of these two supporting the bed at the two points stated; the other across the forward end of the bed. It might be a very bad or a very good way to prevent sagging over an insecure foundation.

MANUFACTURES

Contracts have been let for the building of the South Boston Iron Works, at Middlesborough, Ky.

The Missouri Malleable Iron Company will occupy its new plant at St. Louis, Mo., about April 1.

The Birmingham Brass Company has been incorporated, at Huntington, Conn., with capital of $100 000.

The establishing of a factory to make hemp twine and rope is being agitated at North Platte, Neb.

The S. C. Forsaith Machine Company, of Manchester, N. H., is being fitted with new machinery.

About $14 0 0 worth of new machinery will be set up in the plant of the Taylor (Tex.) Ice Company.

The axe and shovel factory at Monmouth, Me., which was burned, will be rebuilt early in the spring.

The new steel plant annex to the Chester (Pa.) Foundry will be 100 feet longer than at first intended.

The Southern Emery Wheel Company has begun work on the erection of its new plant at Tallapoosa, Ga.

The directors of the British Columbia Iron Works have decided to increase the capital stock to $250,000.

The Swift Manufacturing Company, Columbus, Ga., will add new machinery, for the manufacture of ginghams.

The Napier Iron Furnace Company, of Napier, Tenn., has increased its capital stock from $225,000 to $300,000.

The Rogers Cutlery Company, of Shelburne Falls Mass., are preparing to start up their factory in the near future.

The Moffatt Journal Bearing Company, of Chicago, have increased their capital stock from $100,000 to $1,000,000.

The boiler making firm of Tippett & Wood, at Phillipsburg, N. J., have been incorporated, with a capital stock of $20,000.

The California Engineering Company, of Chicago, Ill., is talking of establishing a $1,000,000 steam engine manufacturing plant.

The city of Highland, Ala., is investigating with a view of putting in an electric light plant. The mayor can give information.

It is stated that the Pembroke iron plant at Washington, Me., is to be converted into a manufactory of electric cars and motors.

C. W. S. Turner has made the citizens of Hagerstown, Md., a proposition for the establishment of a steel plant of 90 tons daily capacity.

The Eames Vacuum Brake Company have purchased a tract of land near Watertown, N. Y., upon which to erect a manufactory.

The Groveland Foundry, at Dighton, Mass., has been purchased by Boston and Taunton parties, who will operate it in the near future.

Isaac Whitaker contemplates organizing a stock company to manufacture fertilizers, using phosphate rock as a basis, at Homeland, Fla.

A company known as the Wellington (O.) Machine Co. has been chartered, to run a foundry and manufacture wood-working machinery.

M. H. Dooly, B. S. Ivy and I. B. Withers will erect a foundry for the manufacture of all kinds of brasses for engines, etc., at Atlanta, Ga.

The Safety Oil Stove Co., capital stock, $50,000, has been organized at Portland, Me. The president is Henry W. French, of Lexington, Mass.

J. B. Ware states that he has a proposition from a Maine capitalist for the establishment of a $1,000,000 cotton-mill at Birmingham, Ala.

A New England party has made a proposition for the erection of a $150,000 cotton-mill in Albany, Ga. The Albany Brick Co. can give particulars.

At Harriman, Tenn., the Harriman Furnace Company, capital stock $500,000, has been organized, for the purpose of erecting an iron furnace.

Park Bros. & Co., Limited, of Pittsburgh, Pa., will increase the capacity of their Black Diamond Steel Works by the erection of two new mills.

H. H. Haines, of Rising Sun, is reported as having purchased the fertilizer and sulphuric acid works of the Clendenin Manufacturing Co., Colora, Md.

An ice factory will be built at Pine Bluff, Ark., by a company now being organized with $60,000 capital. Henry Cook can give further information.

The Stiles Smelting Company, of New Haven Conn., has been incorporated, to manufacture babbitt metals, solders, etc., with a capital of $12,000.

At Geddes, N. Y., the Mohawk Furnace Company has been incorporated, to smelt and reduce iron ore and manufacture pig iron. Capital, $30,000.

J. W. Hancock, of the Rome Ice Factory, of Rome, Ga., is investigating with a view of erecting an ice factory and cold storage plant in Gadsden, Ala.

The Whittier Machine Company will build a machine shop, 140x82 feet, at Granite and First streets, Boston. The building will be of brick, with monitor roof.

At Milford, Mass., the new Coupling and Nozzle Company is soon to commence operations in the Johnson & Ross shop. Five hundred hands will be employed.

The Fort Worth & Rio Grande Railroad has made a proposition to the city council of Brownwood, Tex., for the location of new machine shops at that point.

The United Steel Company, of Pittsburgh, were granted a charter of incorporation last week. Geo. B. Motherell, of Allegheny, Pa., is treasurer of the new concern.

A stock company has been organized, with George Schwarzenbach, president, and Lloyd Lowndes, secretary, to erect an ice factory at Lonaconing, Md.

The Worcester (Mass) Electric Light Company will issue $50,000 additional stock and also $100,000 in bonds. The incandescent plant of the company will be enlarged.

The sale of the Troy (N. Y.) Co-operative Stove Works, consisting of ten buildings, engine, shafting and machinery, has been effected, to William H. Howe, for $20,000.

The Radford Pipe and Foundry Company has completed arrangements for putting in three new cranes, and otherwise improving the Anniston (Ala.) Pipe Works.

The Acme Boiler and Radiator Company has been incorporated, at St. Paul, Minn, to manufacture and deal in steel and hot water apparatus. Capital stock, $50,000

The Spiers Manufacturing Co. has been incorporated, with capital of $15,000. The factory is at East Worcester, Mass., and is 156x46 feet, three stories. Bicycles will be made.

There is talk of a new woolen-mill at Denver, Col., the principal stockholders in which would be the firm of Henry Pease & Co., of the Darlington Woolen-mills, England.

It is announced that the Arethusa Iron Works, at New Castle, Pa., are to be enlarged to nearly twice their present size by the doubling of the capacity of the finishing departments.

The organization of the Smith & Phillips Manufacturing Co, Chicago, Ill., has been effected. Capital is $50,000, and the concern will manufacture machinery and other articles.

The Forbes Wheel Company are removing their plant from East Brookfield, Mass., to Holyoke, Mass., where they will occupy the old shop of the Coburn Trolley Track Company.

A new wood-working plant will be established by S. N. Baker & Son, Boothbay, Me., the coming spring. They will erect a building, put in a planer, small saws and other machinery.

The Henry Dalton & Sons Company have filed articles of incorporation at Oakland, Cal. The capital stock is $100,000, and the purpose is to conduct foundry and machine shops, etc.

B. H. Cramp & Co., brass founders, of Philadelphia, will erect a factory 150x60 feet, two stories high, of corrugated iron, in that city, for the manufacture of the Driggs Schroeder guns.

Prentice Brothers, Worcester, Mass, have issued a new catalogue of the machine tools made at their works, in which the tools are well illustrated and described, necessary details being shown.

The National Steel Pipe Mfg. Company, of San Diego and National City, Cal., are building branch works at Perris, Cal. It is expected that the factory will be turning out pipe inside of a month

The Horton Iron Company has been organized at Duluth, Minn., with a capital stock of $500 000 The incorporators are R. H. Harris, R. P. Edson, H. B. Moore and W. G. Horton, of Mayville, N D.

The Baldwin Locomotive Works, of Philadelphia, will erect two new buildings, one 82x85 feet, to be used for the manufacture of car springs, and the other, 80x40 feet, to be used as a boiler house.

It is reported that the Schenectady (N Y.) Locomotive Works will build a new foundry and otherwise increase the plant. These works have very steadily increased their business during the past few years.

Arthur Stern and others, of Cincinnati, O., are investigating with a view of purchasing the Walton Architectural Iron Works property at Covington, Ky., and equipping same for the manufacture of machine tools.

The New Process Rawhide Co., Syracuse, N. Y., favor us with a good many testimonials as to the merits of the rawhide pinions made at the works, which seem to be growing in favor with electric traction companies.

It has been decided to enlarge the nut and bolt works at Muncie, Ind. Eight buildings in all will be erected, and when completed will make one of the largest and most important manufacturing concerns in that locality.

The Egan Company, Cincinnati, O., say that in a test of one of their band resawing machines, made at the box factory of Hoyt & Loomis, Buffalo, N. Y., it made a record of cutting 3,868 feet of 7"x12" lumber in 56 minutes.

The Denver Manufacturing Lock Company is to erect a large factory at Lakewood, Colo, on the line of the Denver, Lakewood & Golden road. The railroad company is preparing to lay a long switch into the grounds of the factory.

The old Consolidated Iron Works plant, at Riverdale, Kan., has been purchased by the Consolidated Iron Company, recently chartered. The company will begin operations at once, and will manufacture sash weights, and do a general casting business.

It is stated that a number of New York capitalists are organizing a company, with a capital of $1,000,000, to erect a smelting plant at Denver, Colo. There are already three large smelters at Denver, each of which will enlarge its facilities at an early date.

The Joliet Sheet Rolling-mill Company, of Joliet, Ill., is reported to have secured the necessary capital for the erection of their plant. A site has been selected, the plans are being prepared for the mill, and construction will be pushed as soon as spring opens.

The Dominion government is being asked to grant a subsidy toward the erection of an iron railroad and carriage bridge across the Petitcodiac River, near Dawson, N. B., or some other convenient point of junction with the Salisbury & Harvey road.

John Steptoe & Co., Cincinnati, O., manufacturers of crank and geared shapers, write us: Have just removed to 177, 179 and 181 East Pearl street, this city, where, with more commodious quarters and facilities, we are in still better shape to manufacture our specialty.

The Columbia Car and Tool Works, of Portland, Oregon, has been formed for the manufacture and sale of machinery, cars, etc. The capital stock of the company is $100,000. Henry Halen, H. H. Lovejoy, Leo Fried, and Maurel Heacock are the promoters of the project.

The Columbian Palace Car Company, of Chicago, has been incorporated, with capital stock of $6,000,000, for the construction and operation of railway cars. The incorporators are Montgomery H. Throop, Jr., Allan C. Story, Alfred C. Brackenbush and George F. Westover.

W. B. Stillwell, T. H. Gignilliat, E F. Bryan and others have incorporated the American Aeronautic Machine Co. at Atlanta, Ga., to manufacture, sell and promote the "flying machine" invented by Mr. Gignilliat. The capital stock is $75,000, with privilege of increasing to $5,000,000.

There is water-works agitation in Norwalk, O.; Chicopee, Mass.; Franklin, Pa.; Jamestown, N. Y.; Coraopolis, Pa.; Salineville, O; Stockton, N. J.; Quincy, Mass; Bowling Green, O.; Sharon, Pa.; Cumberland, Md.; Rockville, Conn.; Spring Garden, Ala.; Aurora, Ill.; Lachute, Quebec.

The Chester Pipe and Tube Co., of South Chester, Penn., have placed a contract for their new building with The Berlin Iron Bridge Co., of East Berlin, Conn. The building will be 52 feet in width by 170 feet long, and constructed of iron, no woodwork being used about the construction.

The Morton Manufacturing Co, Muskegon, Mich., reports that orders are good, with every evidence for a good year's work. Amongst recent shipments of keyway cutters is one to the Pennsylvania Iron Works which will cut through a hub six feet, cutting a keyway six inches in width.

The Railway Automatic Time and Danger Signal Company, of Des Moines, Ia., has been incorporated, with capital stock of $100,000. The company will manufacture a time and danger signal for railways. The incorporators are E. R. Hutchins, N. Platt, R. E Fitzgerald and others, of Des Moines, Ia.

Superintendent Morris, of the American Tinplate Works, Elwood, Ind., has gone to Youngstown, O., to procure the necessary machinery for the manufacture of tin-plate. Buildings for the tin-plate company are now ready to receive the machinery. It will be the largest tin-plate plant in the United States.

A bill to incorporate the Electric Light and Power Co., of Baltimore County, has been introduced in the legislature. It is empowered to manufacture and sell electricity for light or power, etc., at Towson, Md. Among the incorporators are W D. Randall, J. E. Ingram, W. C. Loundes and others; capital stock, $500,000.

Sutton & Steele, Dallas, Texas, write us: We are now forming a $50,000 stock company of our machine business, for the purpose of manufacturing dynamos, motors, etc., for the southern trade, and for manufacturing low tension incandescent circuit arc lamps, on which we hold several patents. The style of the new company will be The Sutton Steele Electric Mach. Co.

The Penn Steel Casting and Machine Company is being formed, with capital of $150,000, for the purpose of conducting open hearth steel works at Chester, Pa. Fred Baldt, formerly connected with the Standard Steel Company, will be the general manager of the new company. The plant formerly occupied by the Chester Foundry and Machine Company will be used, and a new foundry will also be erected.

Machinists' Supplies and Iron.

NEW YORK, February 13, 1892.

Iron—American Pig—The market remains dull and stocks are increasing. Sales are undoubtedly being made below the regular quotations.

We quote Standard Northern brands, No. 1 Foundry, at $17 to $17.50; No. 2, $15 75 to $16.50; Grey Forge, $14 to $14 50. Southern brands of good quality are obtainable at $16 to $17 for No. 1 Foundry; $15.50 to $16 for No. 2; $13 75 to $14 for Grey Forge.

Scotch Pig—Coltness is quoted at $21.50; Eglington $20.25.

Antimony—Prices are somewhat lower, and we quote Hallett's, 11c.; L. X., 12c. to 12½c.; Cookson's, 14¾c to 15c.

Copper—Prices are unchanged, and the market is steady. Lake Copper is rated at 10 60c. to 10 75c., and Casting Copper, 10¼c. to 10⅝c.

Lead—Prices have declined and sales are reported at 4.05c. to 4 1c. It is intimated that still lower figures would buy.

Lard Oil.—The market is higher and steady: 57c. for Prime City, and Western on spot 56c.

Spelter—There has been some increase of business, and the market is steadier. Values here range at about 4.60c.

Tin—The market remains steady, and there is no speculative interest to speak of. The nominal spot price is 19.6c.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. Seven words make a line, and the address as desired to appear should be included. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Mech draftsman of first-class ability desires position in N. Y. or vicinity. Box 50, AMER. MACHINIST

Wanted—A draftsman who has had experience in printing press designing. Box 54, AM. MACHINIST.

Engineer is open for eng. as supt of erection of industrial plants. Box 53, AMERICAN MACHINIST.

Mechanical draftsman wants a situation; New York or vicinity preferred. X., care of AM. MACH.

First-class foreman pattern maker desires position as foreman; A No. 1 ref.; quick workman; age, 35; salary, $100 per month. Box 47, AM. MACHINIST.

Wanted—Several first-class machinists; vise and lathe men preferred; can find steady employment at good wages. Ottumwa Iron W'ks, Ottumwa, Ia.

Wanted—Foreman for general jobbing machine shop; write, stating experience, salary expected; give ref. Novelty Machine Works, Owensboro, Ky.

Wanted—A good draftsman; one familiar with pump work preferred; steady work, good wages. Address Improved Pump, care of AM. MACHINIST.

Tool maker, competent and reliable, capable of taking charge of tool room, wants employment; the South preferred. Box 55, AMERICAN MACHINIST.

Wanted—Position as ass't draftsman, by draftsman with good shop exp. in pumping and general machinery Address Penna., AMERICAN MACHINIST.

Wanted—Draftsman and pattern maker in small shop near New York. One to do drafting and make patterns. A permanent position to right party. C. G., AMERICAN MACHINIST.

Advertiser is a thorough mechanic, possesses good address, and is not without school training; is a good draftsman and designer, and is not a slouch as a correspondent. Open to engagement in a leading position; refs. O. K. Box 51, AM. MACHINIST.

Wanted—Young man who has a good practical knowledge of iron, wood and mason work, and possesses executive ability as general foreman in a mfg. establishment near N. Y. State fully, age, previous exp., etc. Box 52, AMERICAN MACHINIST.

Brass foundry foreman with wide exp. in cabinet hard., chandelier and job foundries, wishes position; skilled in aluminum and phosphorized metal alloys; careful handler of men; best ref. B., 131 Lafayette Street, Bridgeport, Conn.

A prac. and educated mech eng., who has successfully filled resp. pos. in mfg. concerns, is open for engagement; good executive; well up in mod. prac. and labor sav. devices, and also in econom'l prod. of dup. and interchangable parts; can take charge of the erec. of a plant from the ground up, including equipment. Progressive, AM. MACHINIST.

We desire to engage the services of a first-class young man to take charge of the erecting rooms of our Blower and Engine Dep't. In addition to being a mechanic must be able to handle men (50 to 75), and possess that rare qual'n, "executive ability." He will not be hampered, being responsible only to gen manager. Buffalo Forge Co., Buffalo, N. Y.

Wanted—An engineer familiar with Corliss engine, and who fully understands the use of indicator, to take charge of a plant in New York City that will be operated day and night. Engineer in charge will be expected to assist in running the engines during the day, and must be a mechanic having had shop experience. Applicant must state age, experience as engineer, and salary expected. Indicator, AM. MACHINIST.

Wanted—A first-class machinist as an assistant foreman; one who has had experience in modern machine shop practice, and who can get out work cheap and accurate; good chance for right man; shop located about 100 miles from Chicago; manufacturers of engines, steam pumps and general foundry and machine business; state experience and wages. Address D. F. & M., care of AM. MACH.

Bradley Hammers

REPUTATION.
Men test everything in this world by what it produces.
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BRADLEY & COMPANY,
SYRACUSE, N. Y.
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WELDLESS
SMOOTH · COLD DRAWN
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Embracing all branches of Steam Engineering. They are the only books of the kind ever published in this country, and are so plain that any engineer or fireman can easily understand them.
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MANUAL OF MINING
By PROF. MAGNUS C. IHLSENG.
450 Pages, 8vo, cloth, - - $4.00
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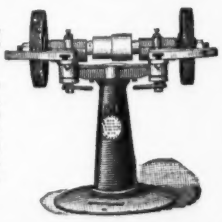
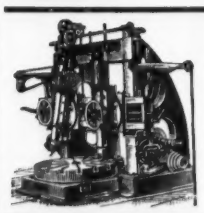
Emery Grinding, Polishing and Buffing Machines.
Bearings yielding or rigid at will.
Wheels *always true and in balance*, dispensing with use of diamond tool and chilled burr, and saving the time, labor, and cutting away of wheels, *otherwise wasted in truing*. Send for Catalogue.
McGRATH & COLLINS,
COHOES, N. Y.



THE NORTON DRILLS.
FOR LIGHT, SENSITIVE AND RAPID DRILLING.
1, 2, 3, 4 or more Spindles, Sensitive or Automatic Feed
To drill from 0 to 1-2 inch holes.
The *Latest* and *Best*; most convenient, sensitive and durable Drill on the market.
Have Balanced Spindles and Balanced Tables.
Write for prices and description, or for Special Machinery.
THE NORTON & JONES
Machine Tool Works,
PLAINVILLE, CONN.
Manufacturers of Machine Tools and Special Machinery.



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14 SIZES—FROM 5 TO 20 FEET.
BETTS MACHINE COMPANY,
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ASBESTOS
ASBESTOS SECTIONAL PIPE COVERINGS.
Non-Conducting Coverings for Steam and Hot Water Pipes, Boilers, etc.
ASBESTOS BOILER COVERINGS.
H. W. JOHNS MANUFACTURING COMPANY,
H. W. Johns' Asbestos Millboard, Sheathings, Building Felts, Fire-Proof Paints, Liquid Paints, Asbestos Roofing, Etc.
87 MAIDEN LANE, N. Y. JERSEY CITY. CHICAGO. PHILADELPHIA. BOSTON. ATLANTA. LONDON.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d hd-lathes & planers. S. M. York, Clev'd, O.

Auto. Steam Flue Cleaners. Kelley Co., Erie, Pa.

Best Portable Forge, $12. Am. Tool Wks., Clev., O.

Wanted—Specialties to build for the Southern trade. Bluefield Iron Works, Bluefield, W. Va.

Engines, special and gen. mach'y designed; ideas developed. A. W. Jacobi, 136 Liberty St., N. Y.

Special machinery designed and built. C. F. Langston & Co., 70 N. 4th St., Philadelphia.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

Best Bolt Header in the world for $50. Address C. H. Baush & Sons, Holyoke, Mass.

Wanted—Specialties to build. Mediapolis Iron Works, Mediapolis, Iowa.

Cheap—Two H. P. Engine Blue Prints complete. Designed to be built on an ordinary lathe. W. A. Smith & Co., 24 Custom House St., Providence, R. I.

For Sale—20-in. drill, 24-in.x12-ft. lathe, 17-inch shaper, 12 H. P. boiler, 6 H. P. engine. Address Iron, AMERICAN MACHINIST.

Wanted to Buy—Second-hand Boring Mill, Planers, Lathe, Shapers, Drill Press, Gear Cutting Machine. W. S. Ammon, 216 and 218 Court Street, Reading, Pa.

Bound volumes for 1891. We are now prepared to take orders. Price, $4.00 per volume; express charges payable by purchaser. Address AMERICAN MACHINIST, 96 Fulton street, New York.

Wanted—Engineers to write for catalogue of all the latest and most valuable mechanical, scientific and electrical books which are given free with each barrel of the Pittsburgh Boiler Scale Resolvent. Pittsburgh Boiler Scale Resolvent Co., Pittsb'gh, Pa.

Foundry business for sale; doing a good trade at present time; situated in a nice town in New Jersey, 30 miles from Phila.; two R. R. to New York & Phila. A man with some capital can get a bargain. Price, $5,500. Good reason for selling. Address Iron Founder, care AMERICAN MACHINIST.

Machine Tools in Stock.

ENGINE LATHES.

78 in. swing,	9 ft. between centers			Sellers
38 do	17 ft. bed.	New		Fifield
30 do	14 do	do		do
28 do	12 do	do		
27 do	16 do	do		
24 do	12 do	do		Fifield
24 do	12 do	do		Fitchburg
24 do	12 do	do		Flather
22 do	10 do	New Pattern		Fifield
22 do	12 do	do		do
22 do	12 do	New		Blaisdell
22 do	8 do	do		Flather
22 do	10 do	do		do
20 do	8 do	do		do
20 do	10 do	do		do
18 do	8 do	do		do
18 do	10 do	do		do
18 do	8 do	do		Blaisdell
18 do	15 do	do		do
16 do	6 do	do		Flather
16 do	6 do	do		Blaisdell
15 do	6 do	do		Flather
14 do	6 do	do		do
14 do	6 do	do		Blaisdell
12 do	6 do	do		do

PLANERS.

42 in. wide,	42 in. high,	12 ft. long,	2 heads	Gleason
36 do	36 do	8 do		Pease
30 do	30 do	8 do		do
30 do	30 do	8 do		Whitcomb
30 do	30 do	8 do		Flather
26 do	26 do	6 do		do
24 do	24 do	6 do		do
24 do	24 do	6 do		Whitcomb
22 do	22 do	5 do		do
22 do	22 do	6 do		Flather

SHAPERS.

12, 16, 20 and 24 inch stroke	Eberhardt
15 and 24 inch stroke	Hendey
32 inch stroke with key-seating attach.	Walcott

UPRIGHT DRILLS.

20, 21, 25, 28, 30 and 36 inch swing	Prentice
20, 23, 25, 28 and 34 inch swing	Blaisdell
60 inch swing Radial Drill	Baush

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New and Second-Hand Machinery.

ENGINE LATHES:—15 in.x 6 ft.; 16 in.x6 ft.; 18in.x 6 ft.; 18 in.x7 ft.; 18 in.x8 ft.; 20 in.x7½ ft.; 20 in.x8 ft.; 21 in.x8 ft.; 21 in.x10 ft.; 24 in.x20 ft.; 28 in.x 12 ft.; 28 in.x16 ft.; 32 in.x14 ft.; 32 in.x16 ft.; 32in.x18 ft.; 33 in.x12 ft.; 60 in.x22 ft.; 72 in.x17 ft.; 84 in.x 16 ft.; Gap Engine Lathe 24 in. swing over bed, 48 in. swing in gap, 26 ft. bed, with raising block, to make 36 in. swing over bed, and 60 in. swing in gap. Gap Engine Lathe 19 in. swing over bed, 35 in. swing in gap, 15 ft. bed.

IRON PLANERS:—24 in.x24 in.x4 ft.; 24 in.x24 in.x5 ft.; 24 in.x24 in.x6 ft.; 26 in.x24 in.x5 ft.; 28 in.x28 in.x8 ft.; 30 in.x30 in.x7 ft.; 30 in.x30 in.x8 ft.; 32 in.x32 in.x10 ft.; 36 in.x36 in.x10 ft.; 54 in.x42 in.x24½ ft., two heads; 62 in.x42 in.x16 ft.

UPRIGHT DRILLS:—20 in. swing, 26 in. swing, 30 in. swing.

SHAPING MACHINES:—9 in stroke, 11 in. stroke, 12 in. stroke, 16 in. stroke.

SLOTTING MACHINES:—9 in. stroke.
1 No. 2 Brainard Milling Machine, back geared.
1 No. 3 Union Vise Co. Milling Machine.
1 Heavy Index Milling Machine.
1 Large Horizontal Boring Machine.
1 Boring Machine 30 in. between Uprights.
2 Bolt Cutting Machines to cut to 1 1-4 in.
1 Bolt Cutting Machine to cut to 1 1-2 in.
2 Stay Bolt Cutting Machines.

UPRIGHT ENGINES:—6 in.x7 in.; 7 in.x7 in.; 8 in. x8 in.
10 H. P. Westinghouse Standard.
60 H. P.

HORIZONTAL ENGINES:—6 in.x9 in., Rice Automatic; 6 in.x10 in.; 14 in.x30 in., Corliss.

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Hart's Adjustable "Duplex" Die Stocks

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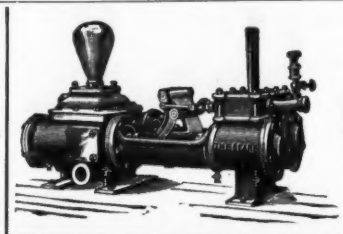
AS USED BY
Machinists, Model Makers, Blacksmiths, &c.
HART M'F'G CO.
16 Wood St.,
Cleveland, Ohio.
Send for Illus Circular

IN ENGLAND.

Americans or others desirous of having high class machinery or tools manufactured in England are invited to communicate with

GRENFELL & ACCLES, L'T'D.
HOLFORD ENGINEERING WORKS.
Perry Barr, Birmingham, England.

G. & A.'s extensive works are fitted throughout with the latest and best types of American machines and tools, and are conducted upon the American system, under the superintendence of American Engineers (formerly of Hartford, Conn.)



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STEAM PUMPS
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PITTSBURGH.
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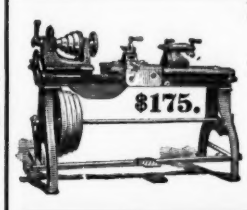
NEW YORK.
NOW USED FOR **TOOLS, DIES, MILLING CUTTERS, &C.**



Improved Screw Cutting Foot and Power.
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167 to 175 Highland Avenue, SIDNEY, OHIO.
MONTGOMERY & CO., 105 Fulton St., New York, Gen'l Agents.

THE TAPS PASS CLEAR, MAKING FULL, THROUGH THE NUTS FINISHED THREADS
THE GREEN RIVER SCREW PLATE.
DIES ALWAYS READY TRUE TO SIZE
PERFECT SCREWS AT A SINGLE CUT

FINE TAPS, DIES, REAMERS, ETC.
Lightning and Green River Screw Plates.
Tap Wrenches, Bolt Cutters, Hand and Power Drilling Machines, Punching Presses and other Labor-saving Tools. **SEND FOR NEW CATALOGUE.**
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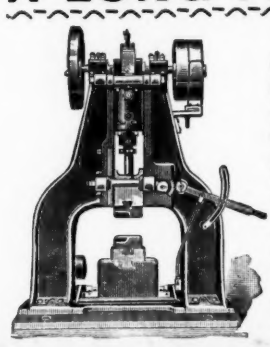

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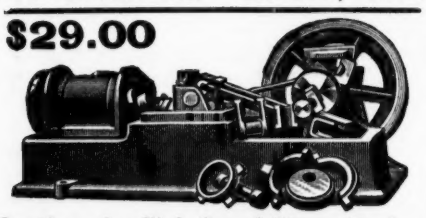

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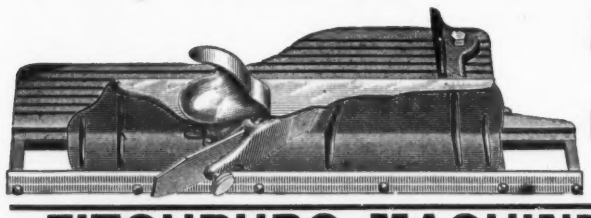

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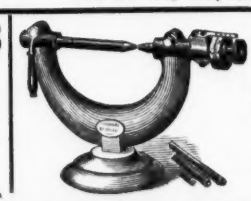

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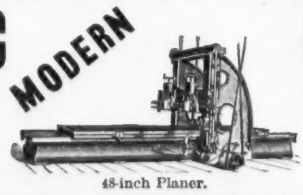
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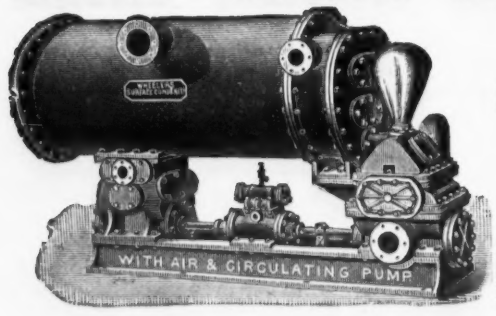

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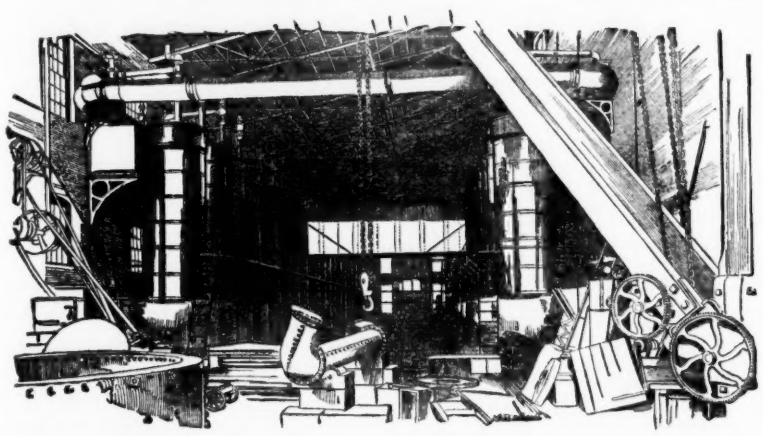

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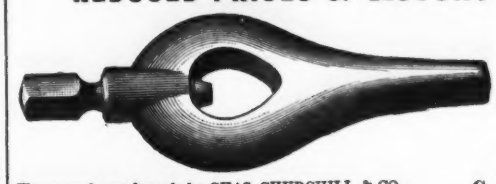

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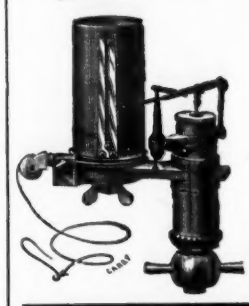

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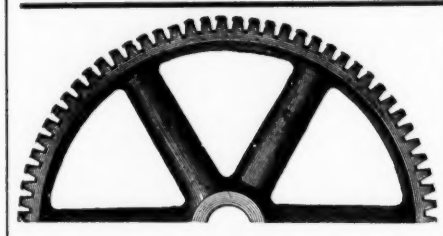

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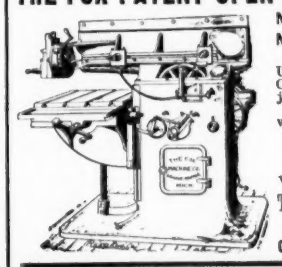

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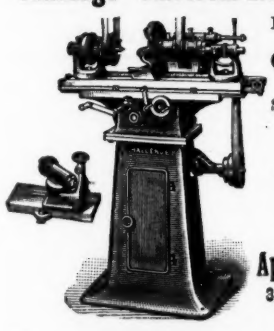

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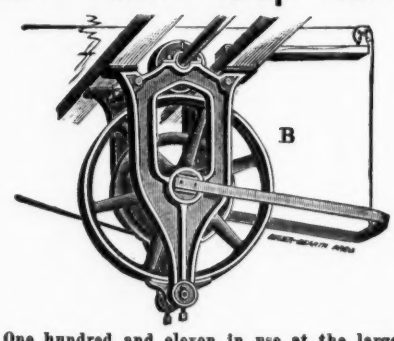

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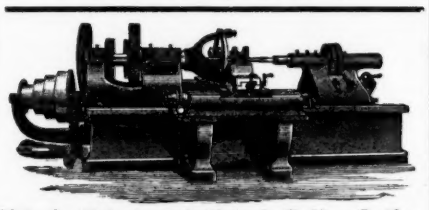

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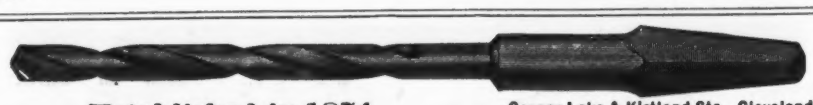

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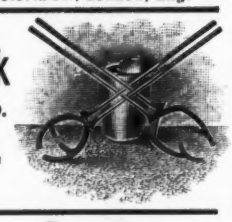

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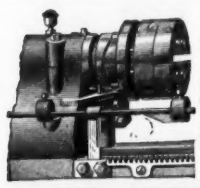

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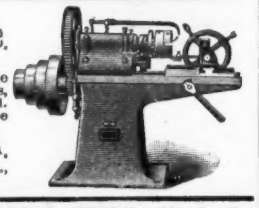

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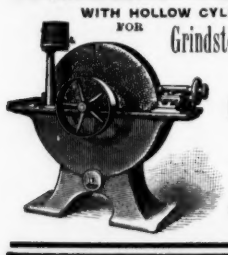

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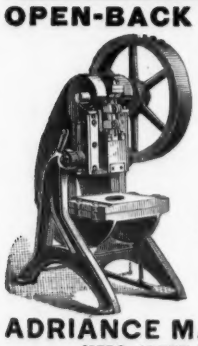

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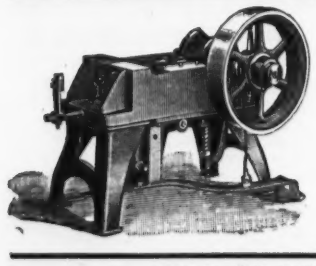

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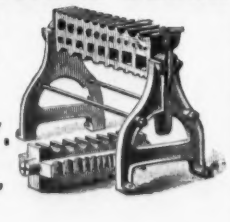

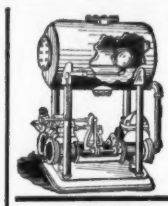

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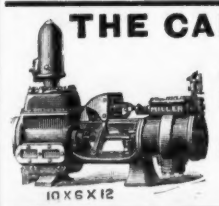

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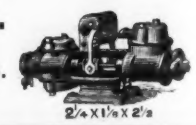

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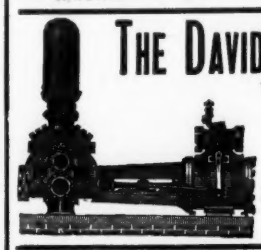

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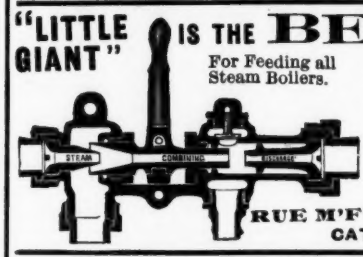

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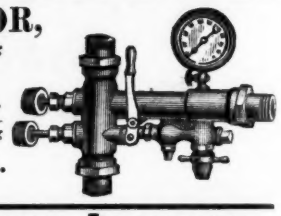

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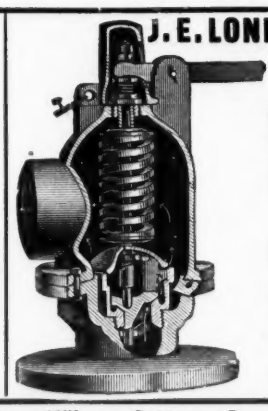

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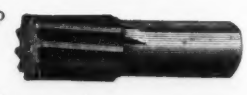

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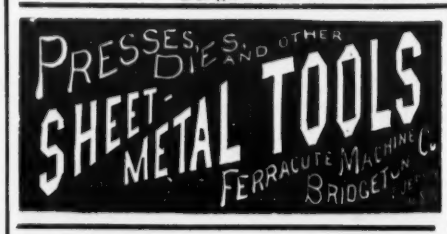

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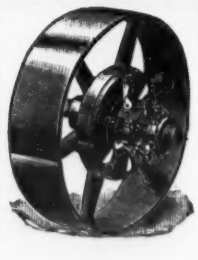

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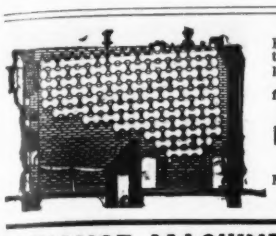

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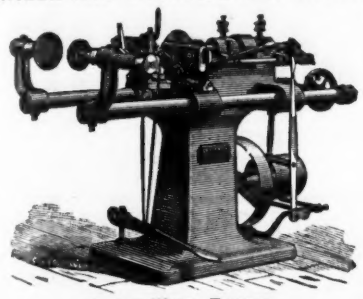

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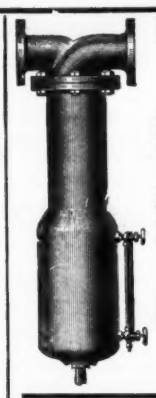

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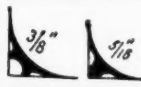

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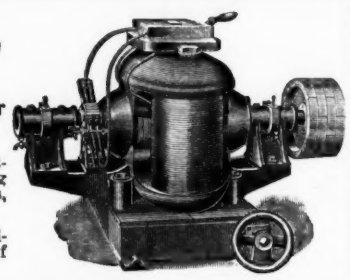

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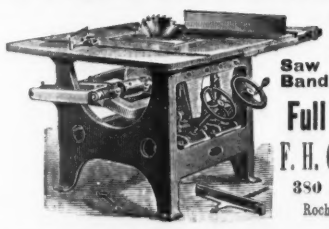

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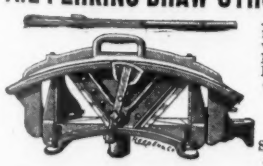

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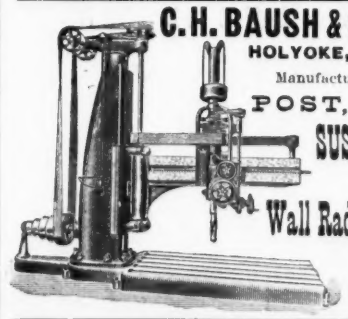

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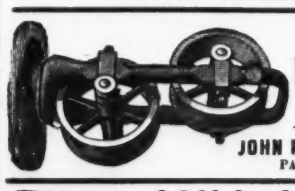

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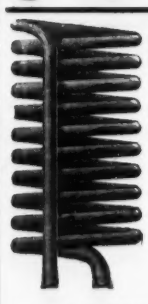

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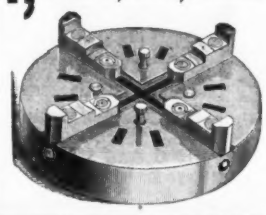

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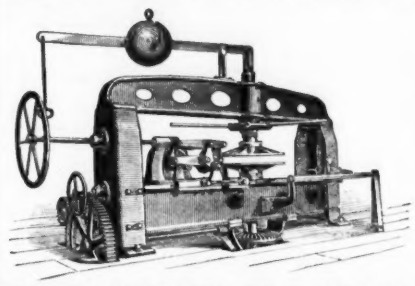

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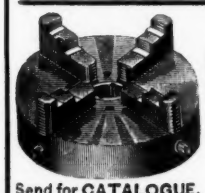

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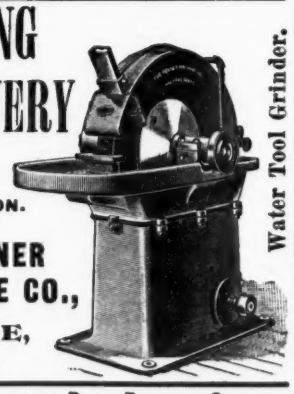

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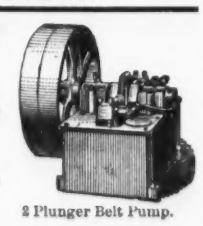

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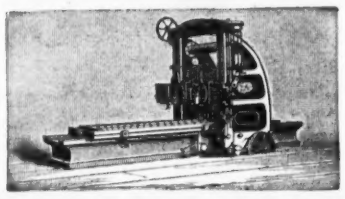

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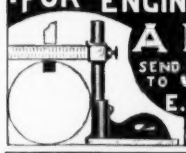

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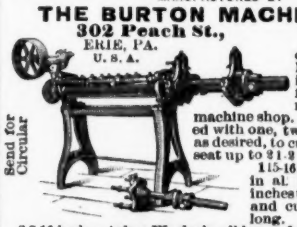

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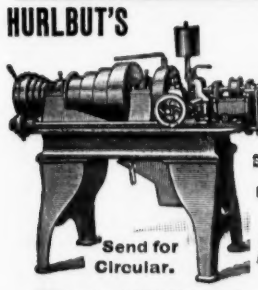

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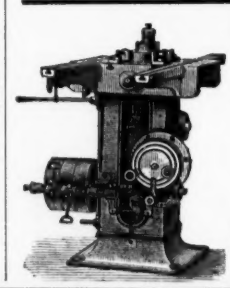

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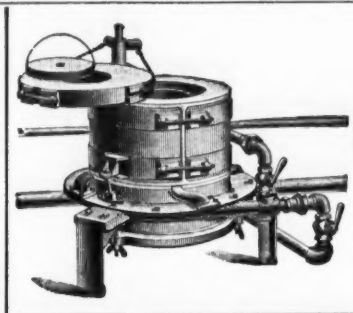

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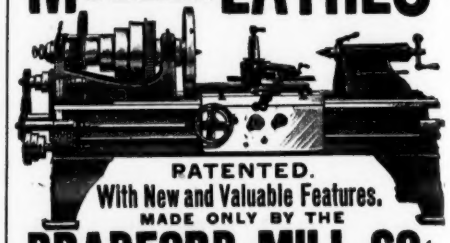

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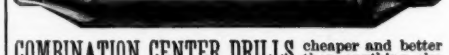

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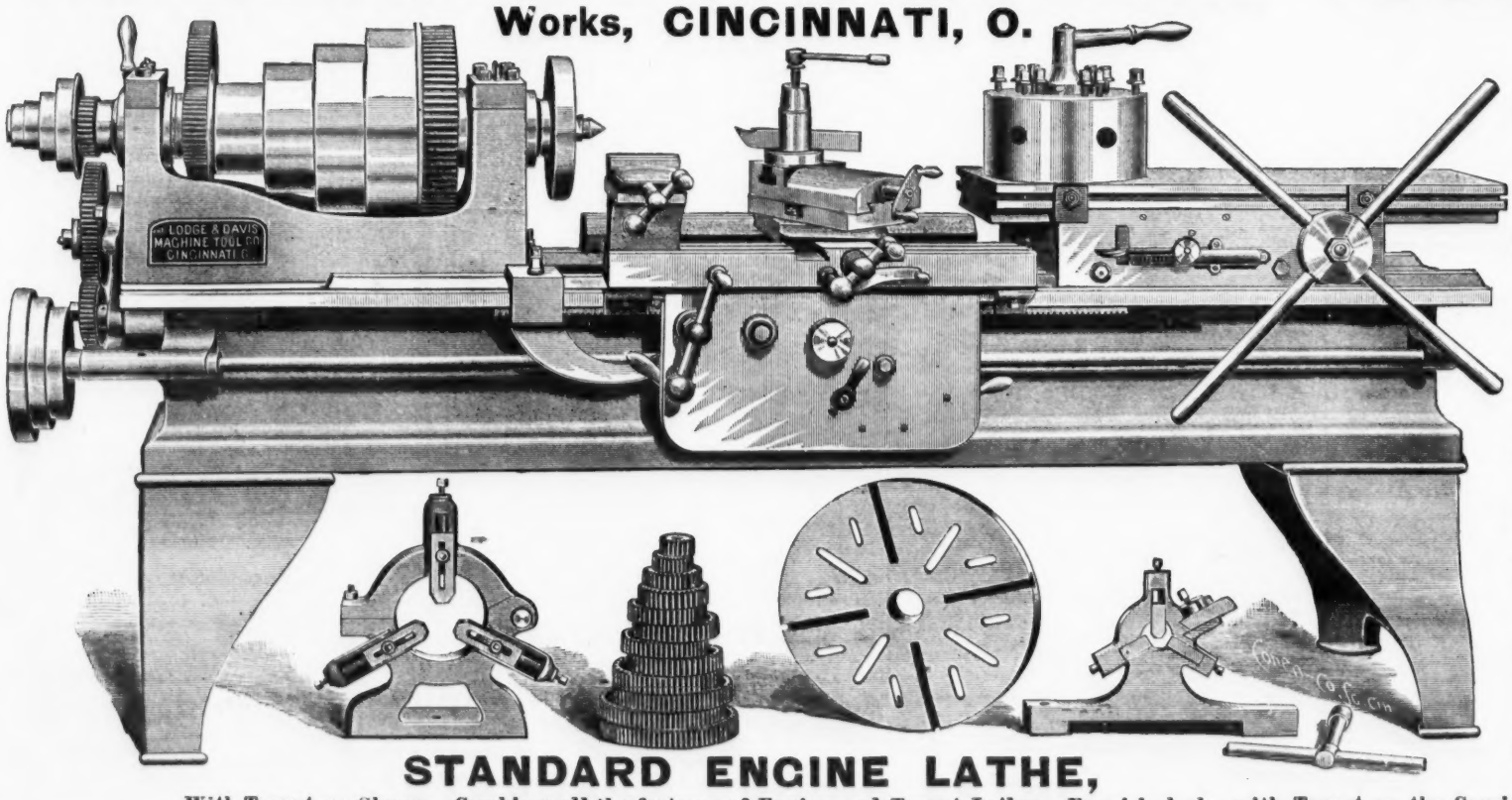

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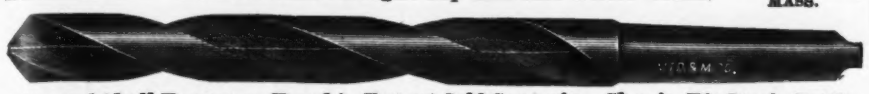

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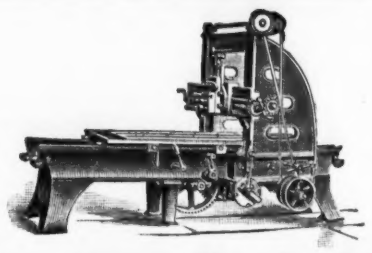

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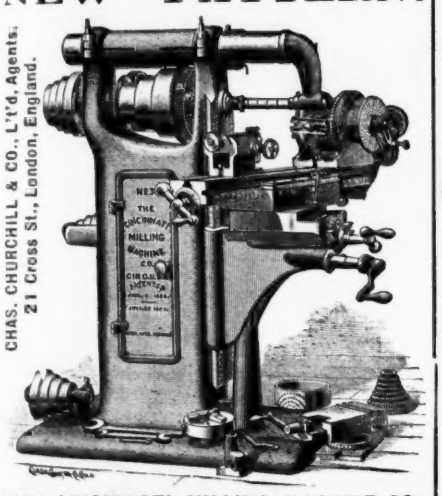

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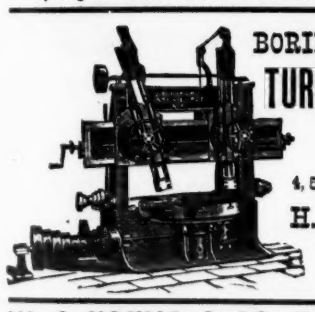

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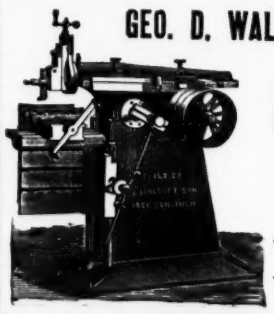

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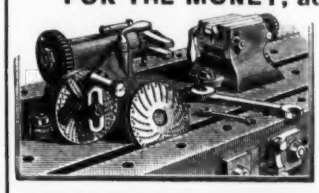

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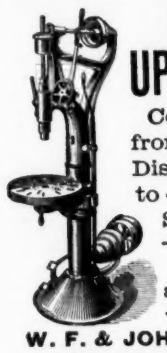

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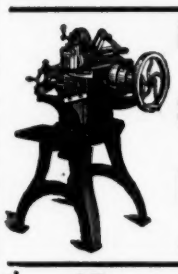

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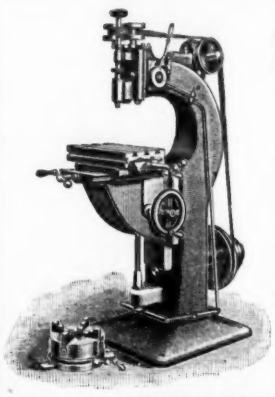

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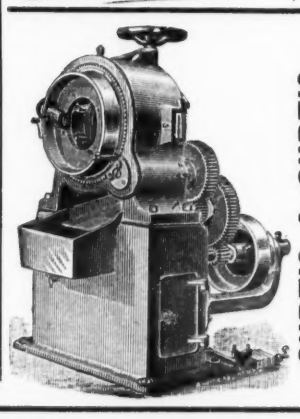

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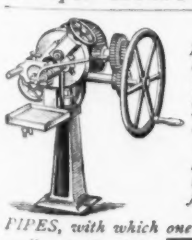

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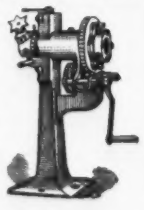

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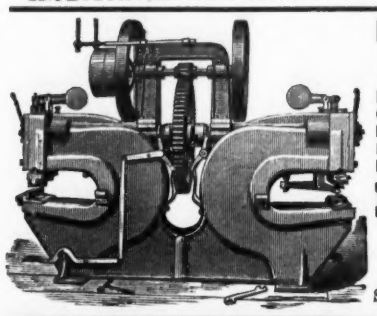
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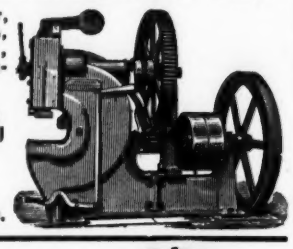

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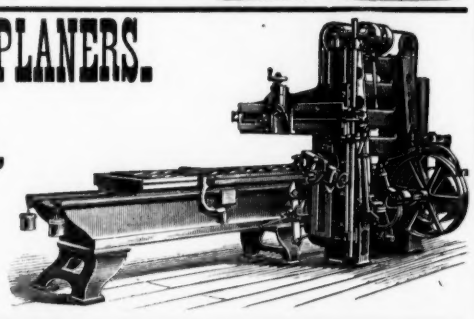

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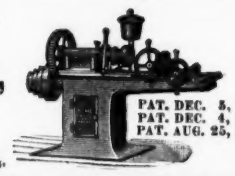
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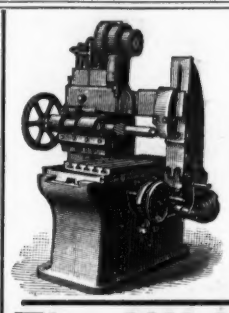
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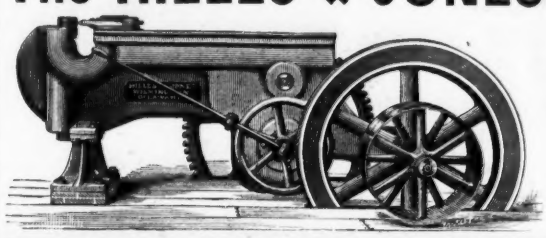
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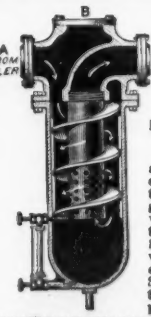

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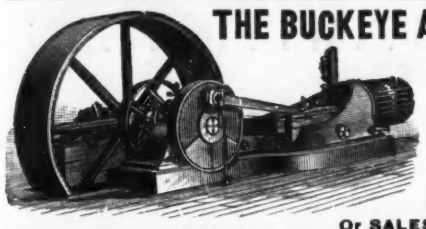

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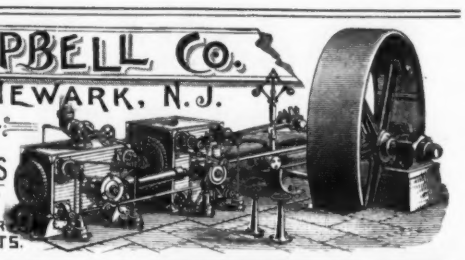

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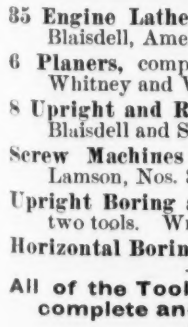

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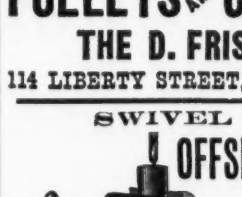

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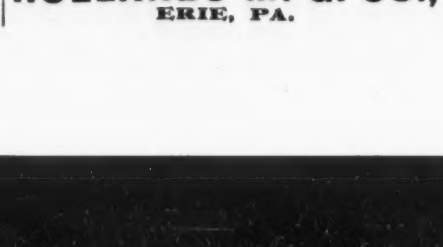

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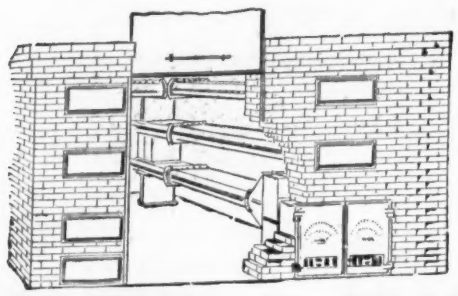

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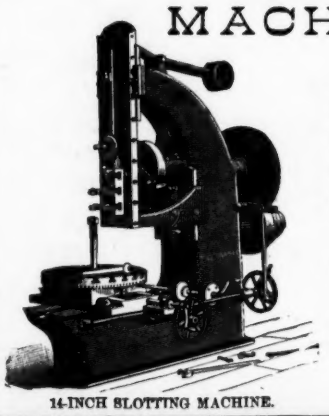

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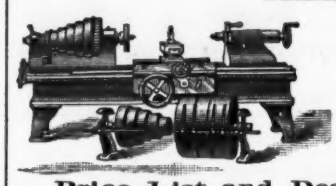

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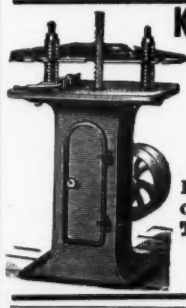

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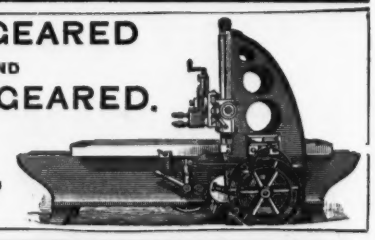

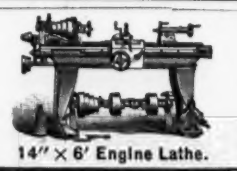

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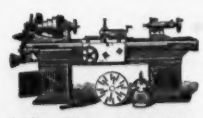

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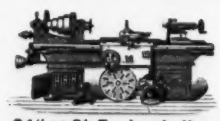

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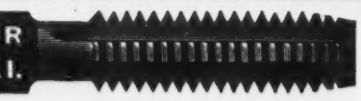

Manufacturer of TAPS & DIES